GENERATION, TRANSMISSION AND APPLICATION OF THE POWER SERVICES • A McGRAW-HILL PUBLICATION

Power

OCTOBER
1956 • 50¢

Malenkov gives POWER publisher first-hand facts about . . .

EXCLUSIVE

SOVIET POWER TODAY

SOLA-FLEX® EXPANSION JOINTS

SHELL CHEMICAL INSTALLATION

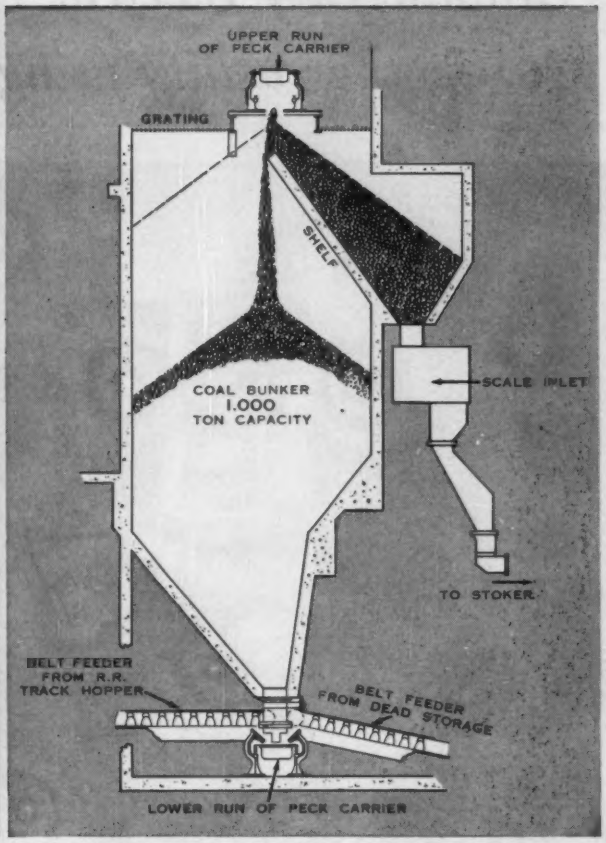
SOLAR
AIRCRAFT COMPANY
SAN DIEGO DES MOINES

1. **CONSTANT MOTION** due to temperature variations occurs in the pipe lines for water cooling a Freon refrigeration unit at Shell Chemical in Torrance, California.
2. Three-span Sola-Flex bellows take the lateral movement of the main piping system in offset. Tie bars prevent end thrust normally caused by the internal pressure.
3. With all stresses safely absorbed by Sola-Flex joints, pipe connections to the cooling tank are in balance and trouble-free service life is assured for all elements of the piping system.

Sola-Flex bellows have many uses in chemical installations. They are custom-engineered in any size, shape or configuration required. Stock items in all standard pipe sizes are also available. Send for a catalog of rugged, economical Sola-Flex joints. Dept. C-77, Solar Aircraft Co., San Diego 12, Calif.

Designers, Developers and Manufacturers • Gas Turbines • Aircraft and Missile Components • Bellows • Controls • Coatings • Metal Alloy Products

PRUDENTIAL BUILDING is the latest of several Chicago landmarks to use Link-Belt coal handling. Naess & Murphy, Chicago, served as architects and engineers. Others: Merchandise Mart, Tribune Tower, Conrad Hilton Hotel, Wrigley Building, Palmer House, Board of Trade Building, Chicago Natural History Museum.



PECK CARRIER travels rectangular path. Coal is loaded along lower run under active storage bunkers . . . elevated vertically . . . carried along top of bunkers and automatically discharged by movable dumper. H. P. Reger Co., Chicago, was heating contractor; George A. Fuller Co., Chicago, was general contractor.

At the Prudential Building—Chicago's newest and tallest skyscraper—it's

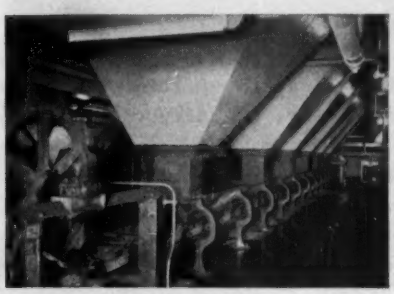
LINK-BELT coal handling equipment

A Link-Belt Peck Carrier and belt feeder help the $40-million Prudential Building match its modern accommodations with equally efficient coal handling. The carrier has pivoted buckets suspended in a way that keeps them upright while travelling either horizontally or vertically. Coal can be handled in a continuous flow without necessity for transfer points.

Such specialized equipment—part of a complete line—and engineering background unexcelled in the field make Link-Belt a leading source for all coal handling needs. We will gladly work with your consultants. Call your nearest Link-Belt office, or write for Book 2410.

LINK-BELT

COAL HANDLING EQUIPMENT



RACK AND PINION GATES on bunkers along lower run permit coal to be recirculated back into Peck Carrier.

MOVABLE TRIPPER can be positioned at any spot along horizontal runs of carrier, allowing pin-point discharge.

BELT FEEDER handles coal from dead storage bin to Peck Carrier. Another brings incoming coal from track hopper.

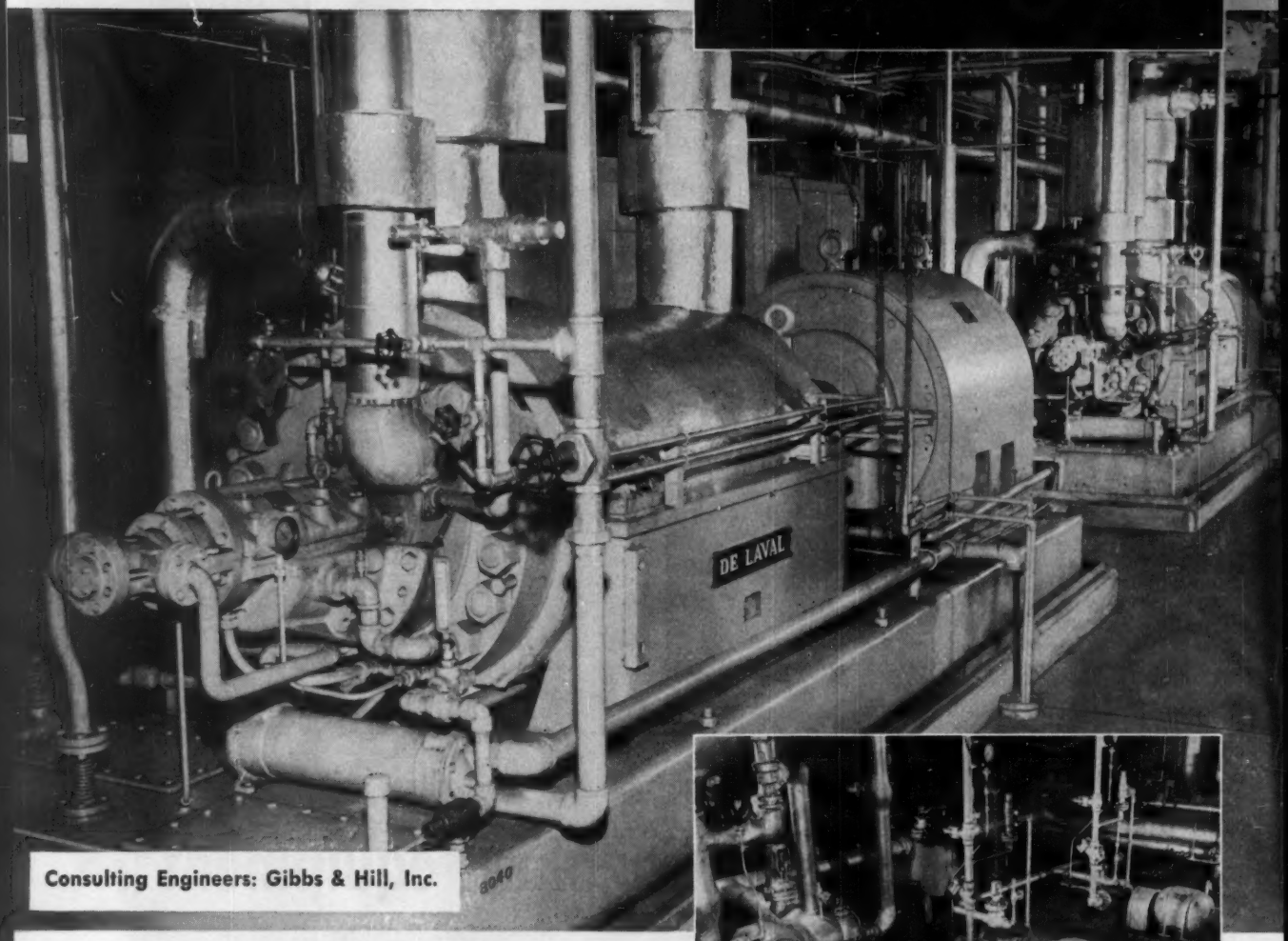
14,223

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

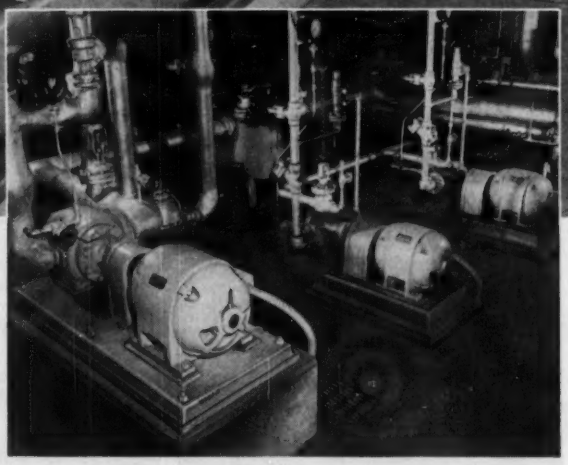
Atlantic City Electric ... another utility using

DE LAVAL

BARREL TYPE BOILER FEED PUMPS



Consulting Engineers: Gibbs & Hill, Inc.



De Laval IMO rotary positive displacement pumps handle heavy fuel oil. They are used for standby operation.

Atlantic City Electric Co. and Gibbs & Hill, Inc., Consulting Engineers, know that they can count on De Laval reliability. That's why they selected three De Laval high pressure barrel type boiler feed pumps for the Deepwater Station in Penns Grove, New Jersey. These 10-stage units deliver 675 gpm, operating at 1762 psi with temperature at 287 F. The pumps are driven by 900 hp motors.

De Laval barrel type boiler feed pumps operate at pressures up to 5500 psi. These units offer many important design advantages, such as double volute diaphragm, individual diaphragm bolting, only one inner high-pressure joint, and bare shaft construction. Their dependability is proven by year in, year out service in public utilities and industrial plants.

Readers of this publication can obtain the De Laval Engineering Handbook (Regular Price $3.00) for one dollar. Its 336 pages contain mathematical, mechanical, fluid and other data on turbines, pumps, compressors and reduction gearing. Write for your copy.

DE LAVAL *Boiler Feed Pumps*

DE LAVAL STEAM TURBINE COMPANY

815 Nottingham Way, Trenton 2, New Jersey

DL-243

Power

OCTOBER 1956 • VOLUME 100 NUMBER 10

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Print order this issue: 48,660

OFFICIAL RUSSIAN PHOTO, cover, shows Georgi M Malenkov with Shelton Fisher, POWER's publisher. On his recent visit to the U.S.S.R., Fisher took more than 500 photos of his own. He used a 35-mm camera with a wide-angle lens, high-speed film. Some results are shown in report on *Soviet Power Today*, starting on p 73. Soviets had no objection to Fisher's photo taking during any part of his trip.

Next month . . .

Untamed plant noise presents industry with many headaches—from impairment of worker's hearing to the cause of accidents. Earmarked as an answer to the problem is a portable instrument that probes the source to measure noise level. Coming article shows how it works to solve your noise problems.

Blowoff valves will enjoy a long life if given proper care. Right lubrication and correct operation can mark the difference between efficient valve performance and boiler disaster. Fast-reading article maps the correct route to practical maintenance.

Hot-water heating is proving to be a safe, efficient power-service operation. Next month, two experts give their report on actual systems, typical plants, heat transfer, expected savings.

Centrifugal pumps, plus partial shroud vanes on impellers, add up to reduced thrust load. Coming 2-pager gives dope on their design, use, performance.

. . . and future months

Special report, in December, wraps up all the latest thinking on corrosion.

October 1956 POWER Vol. 100—No. 10

POWER (with which are consolidated *Science and Industry, The Engineer Review, The Engineer, The Stationary Engineer* and *Operating Engineer*) is published monthly with an additional Handbook statistical number in September, by McGraw-Hill Publishing Company, Inc. James H McGraw (1860-1948), Founder. PUBLICATION OFFICE: McGRAW-HILL BUILDING, 330 W 42nd St, New York 36, N. Y.

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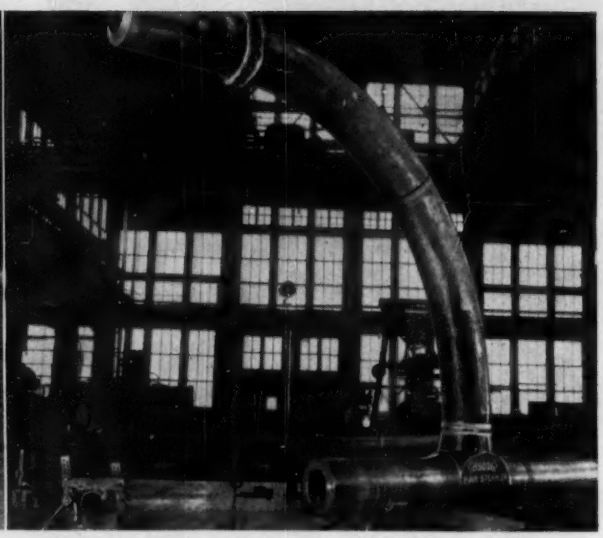
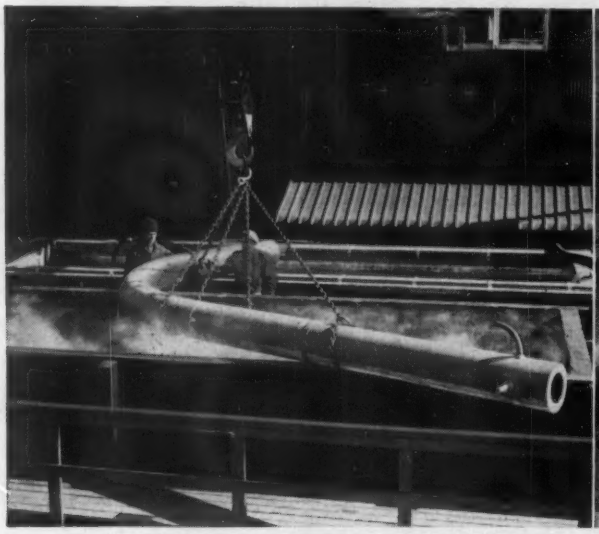
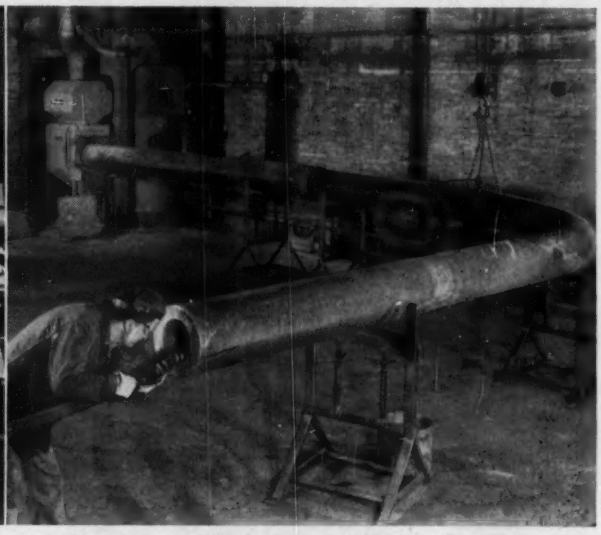
Crane's skilled shopmen bend 17¾" O.D. pipe with 3¼" wall. Pipe bend is for steam service—1970 lbs. at 1050 deg. F.



Experienced Crane welders have welded the bend (see photo 1) to header. Pipe is 2¼% chrome, 1% moly, alloy steel. Unit shown weighed 15,000 lbs.



Pipe bend fabricated by Crane is being pickled as part of cleaning procedure. Pipe is chrome-moly alloy—2.539" wall thickness; 13.578" O.D. Unit weighs 9050 lbs.



Pipe shown at left also was shot-blasted. Combining pickling and shot-blasting assures maximum interior cleanliness.

Let CRANE fabricate your heavy-wall pipe

Do your high pressure-high temperature piping specifications call for bending and fabricating pipe of greater wall thicknesses than the maximums shown in Schedule 160 thicknesses?

Crane shops for years have been processing heavy-wall pipe ranging in thicknesses up to 3.750"; in O.D. pipe sizes from 11.690" to 21.000"!

Crane facilities include bending, welding, upsetting, machining, full furnace stress-relieving or heat treating, radiographic inspection, and thorough interior cleaning.

All Crane facilities are housed under *one* roof for fastest service—and controlled and operated under *one* responsibility. Thus, you are assured of traditional Crane quality in materials, engineering supervision, and skilled shopmanship—that effect important economies in erection, operation, and maintenance for years to come.

For prompt consultation write to address below.

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speaking of Power

Why Russia rolled out the welcome mat for Power's publisher

AMBASSADOR BOHLEN:
the Soviets will cooperate

As Shelton Fisher stepped off a SAS airliner at the Moscow airport some weeks back, he was greeted by a well-dressed man who introduced himself as Nicholas Galotchkin. As Chief of Foreign Relations for the Soviet Power Ministry, Galotchkin indicated to POWER's publisher that the welcome mat was out. And it stayed out for the remainder of Fisher's visit with the Soviets while he dug out the facts on the U.S.S.R. power picture. This cooperative and right-friendly attitude toward an American publisher reflected a feeling of respect in addition to a change in Soviet procedure.

Ambassador C E Bohlen, meeting with POWER's publisher during the latter's first day in Moscow, forecast a highly successful visit. Bohlen's predictions were based, in part, on the admiration many of Russia's top men seem to have for POWER's parent company, McGraw-Hill. *Example*: At a recent Embassy party Bohlen said he was chatting with N K Baibakov, head of the current 5-yr program, and N G Pervukhin, a top man in the Soviet Council of Ministers. Both Baibakov and Pervukhin spoke knowingly of the contributions McGraw-Hill has made and is making in the field of business-paper publishing. Fisher detected a similar feeling of respect in many other areas, especially within the U.S.S.R. Power Ministry. This admiration proved a mighty important factor in getting the full report on Soviet power, starting on p 73 of this issue.

Fisher's first meeting with Russian engineers brought to light a basic interest in McGraw-Hill. Russian interest ranged all the way from how McGraw-Hill was founded to its current financial position. In reply, Fisher painted a verbal picture of McGraw-Hill's beginning during the era of rapid industrial expansion around the latter part of the 19th century. It was at that time James H McGraw, John A Hill and a few other publishers recognized the need for a competent technical and business press built upon a foundation of independent journalism and publishing integrity. Fisher pointed out it was this early vision of a basic need, backed by ability to give it practical expression, that pioneered the contribution made by industrial publishers to all American business.

Lesson in capitalism was next on the docket. This came about in response to a Soviet question about ownership of McGraw-Hill. Although the question was far afield of the Russian power situation, Fisher carefully explained the financial structure of McGraw-Hill and incidentally used it as an example of how American capitalism works. The Russians were keenly interested in the basic financial equation found throughout industry where anyone can buy stock in a corporation and, hence become part-owner of the business; and how in becoming part-owner they automatically assume all risks as well as benefits. A few of the Soviets found it difficult to grasp just how a working man could buy stocks on the open market.

There are many such interesting items, within and outside the straight technical field, studded throughout the report on *Soviet Power Today*. It makes for plain good reading.

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Year after year, for 75 years, B&W has been privileged to supply boilers for various plants of the Solvay Process Division of Allied Chemical and Dye Corporation. The newest plant, now being built at Brunswick, Georgia, for operation later this year, will also be equipped with B&W units.

Solvay's confidence has been built on satisfactory experience with B&W Boilers of many types . . . has been strengthened by a 75-year record of performance and service. For example, in the comparatively short period from the start of World War II to date, this leading industrial company has ordered B&W boilers—including Integral-Furnace and Stirling Units—having a total steam capacity of over 2,000,000 lb per hr.

Advanced research and equipment development to *keep steam generating costs down for requirements of every size* is an established policy at B&W. Add an assurance of service that goes far beyond normal requirements, and you know why industrial, utility, and other users across the nation have made repeat orders an old story at B&W. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.

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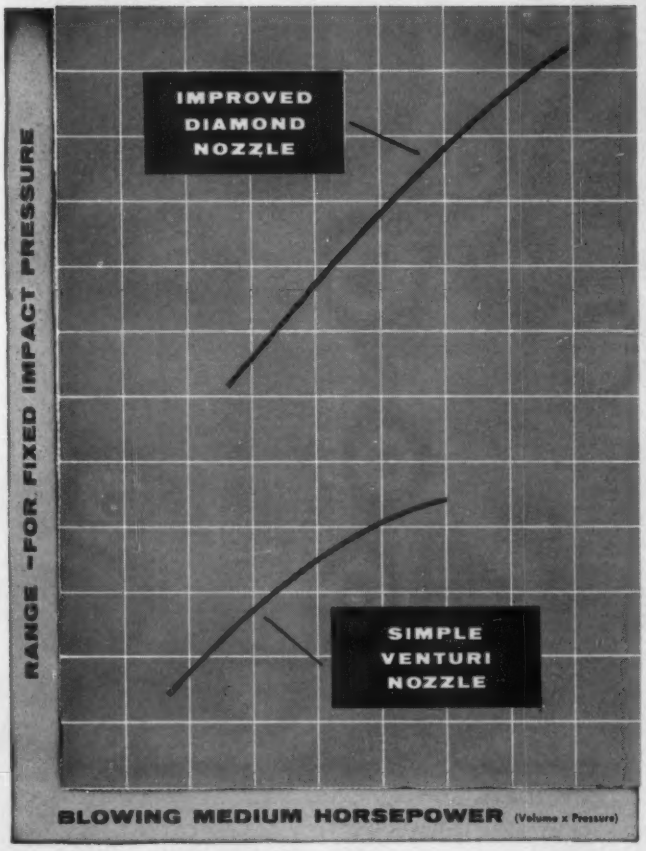
GETTING BACK TO FUNDAMENTALS:

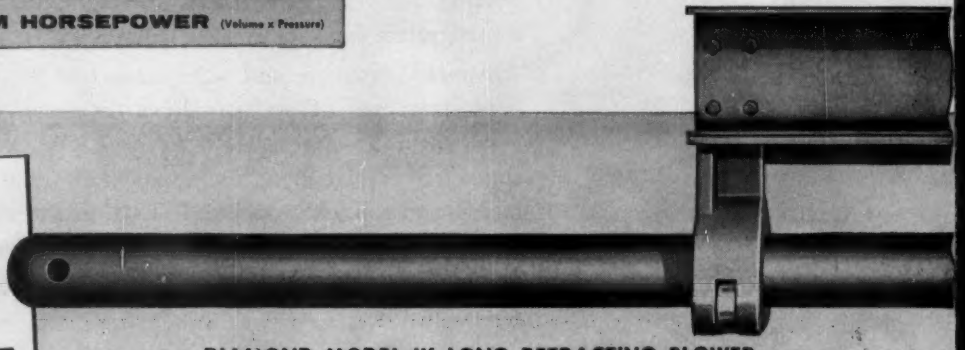
Efficient BOILER CLEANING


IMPROVED DIAMOND NOZZLE
SIMPLE VENTURI NOZZLE
RANGE - FOR FIXED IMPACT PRESSURE
BLOWING MEDIUM HORSEPOWER (Volume x Pressure)

The blower nozzle has the job of converting steam or air pressure into velocity which, in turn, produces impact pressure at the surface to be cleaned. Effective cleaning depends on this impact pressure. A well-designed nozzle will convert much more efficiently . . . doing a better cleaning job with less steam or air.

During the past several years Diamond has conducted intensive research into nozzle design to find the ultimate in efficiency. (More than 50 designs were tested.) It was soon found that nozzle design responds to perfection of detail. Among the details studied were: (1) divergence angle of nozzle, (2) inlet radius as a function of throat diameter, (3) length-diameter ratio of nozzle, (4) area ratio of lance to nozzle throat, and (5) nozzle approach conditions. A product of this research is our new "Type A" Nozzle for Model IK Blowers. The curves at the left show how much more efficient it is than the simple venturi nozzle. The result is improved cleaning at substantially lower energy cost.

YOU CLEAN BOILERS *BETTER* and at *LOWER COST* with DIAMOND BLOWERS



DIAMOND MODEL IK LONG RETRACTING BLOWER

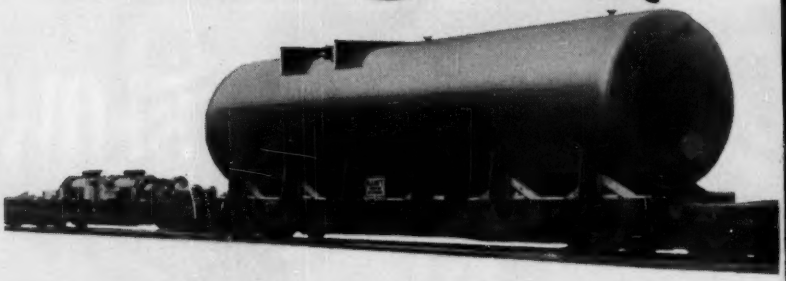
A SINGLE motor (air or electric) both rotates and propels the long lance tube through a simple and rugged gear system. Only one set of motor elements, one set of control elements and one set of power supply facilities to operate and maintain. Flow control of blowing medium (steam or air) is automatic, positive and accurate by means of a simple, mechanically operated valve. This valve is poppet type and has adjustable pressure control. The improved nozzle design coupled with the close helical cleaning pattern assures maximum effectiveness for each blower operating cycle. For additional advantages, write for Bulletin 1080 U.

Starts at the BLOWER NOZZLE

Photograph of section through Diamond "Type A" Nozzle.

The two photographs at the left show the Improved Diamond Nozzle and the simple venturi nozzle under identical test conditions. These tests proved that the effective range of the new Diamond nozzle is substantially greater. Also that at the same range, the impact pressure of the Improved Diamond Nozzle is much higher than for the simple nozzle. For equal cleaning ability, the higher efficiency of the new Diamond nozzle requires a much lower blowing medium pressure.

We don't kiss them goodbye



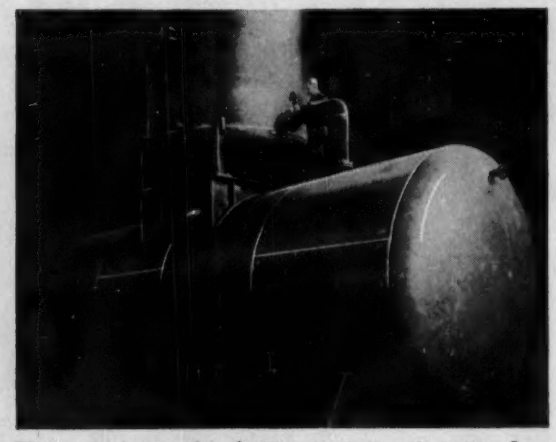
ELLIOTT DEAERATING HEATERS

You get a complete Elliott job when you order an Elliott Deaerating Heater!

Elliott staff engineers do the design work, operating in a tradition set by forty years of Elliott deaeration progress and experience.

Construction starts on a large deaerating heater. All construction work is done in the large, well-equipped Elliott, Jeannette, Pa. plant.

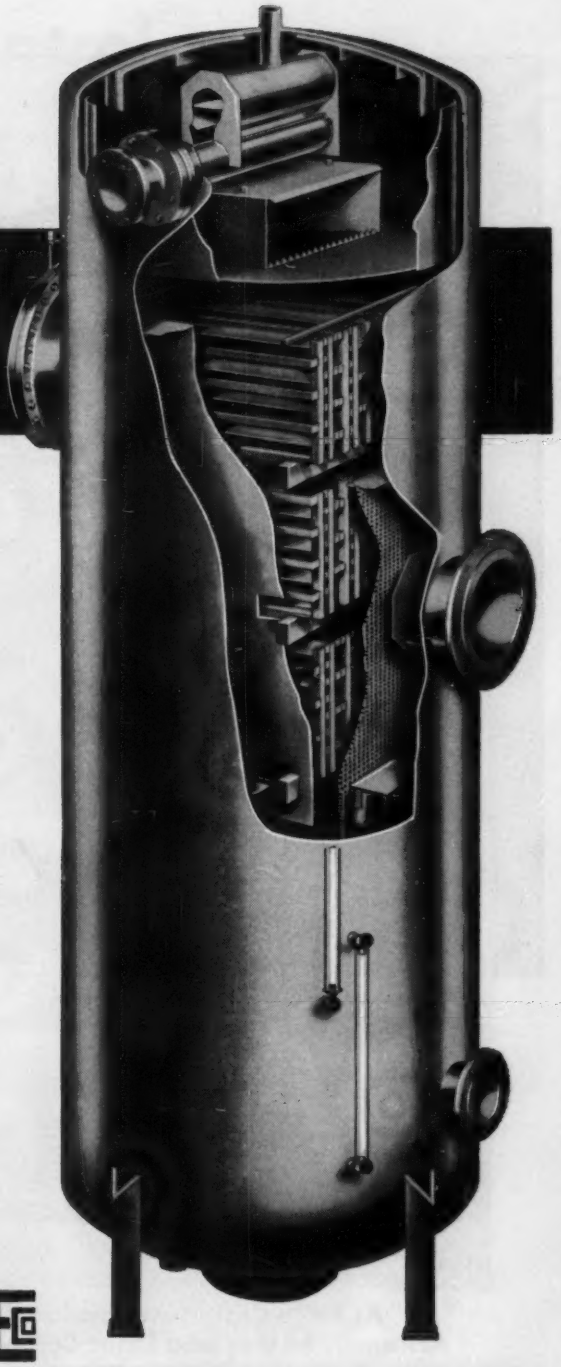
The Elliott welding shop where the "big ones" are built. Construction is in accordance with rigid ASME code requirements.

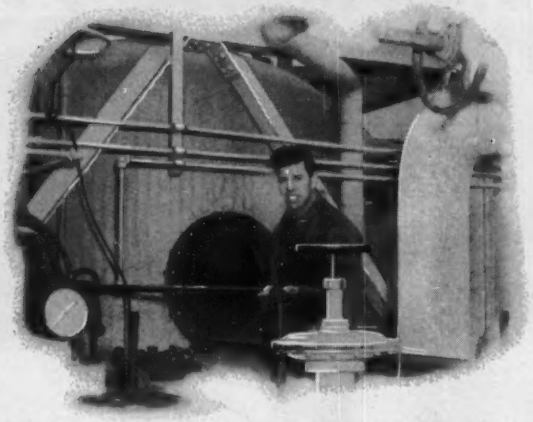


Elliott maintains complete facilities for hydrostatic testing. Every Elliott deaerating heater receives an "ok" here prior to shipment.

on the freight siding!

...are backed by field service attention throughout installation, start-up and operating life.





Elliott engineer inspects deaerating heater installation during periodic plant shutdown.

Elliott deaerating heaters are not only designed and fabricated in the Elliott Company headquarters plant, but are backed by Elliott factory-trained field engineers who are available for consultation on pre-installation questions, and for help on start-up and maintenance throughout the life of the equipment. For complete information on Elliott deaerating heaters, write Elliott Company, Jeannette, Pa.

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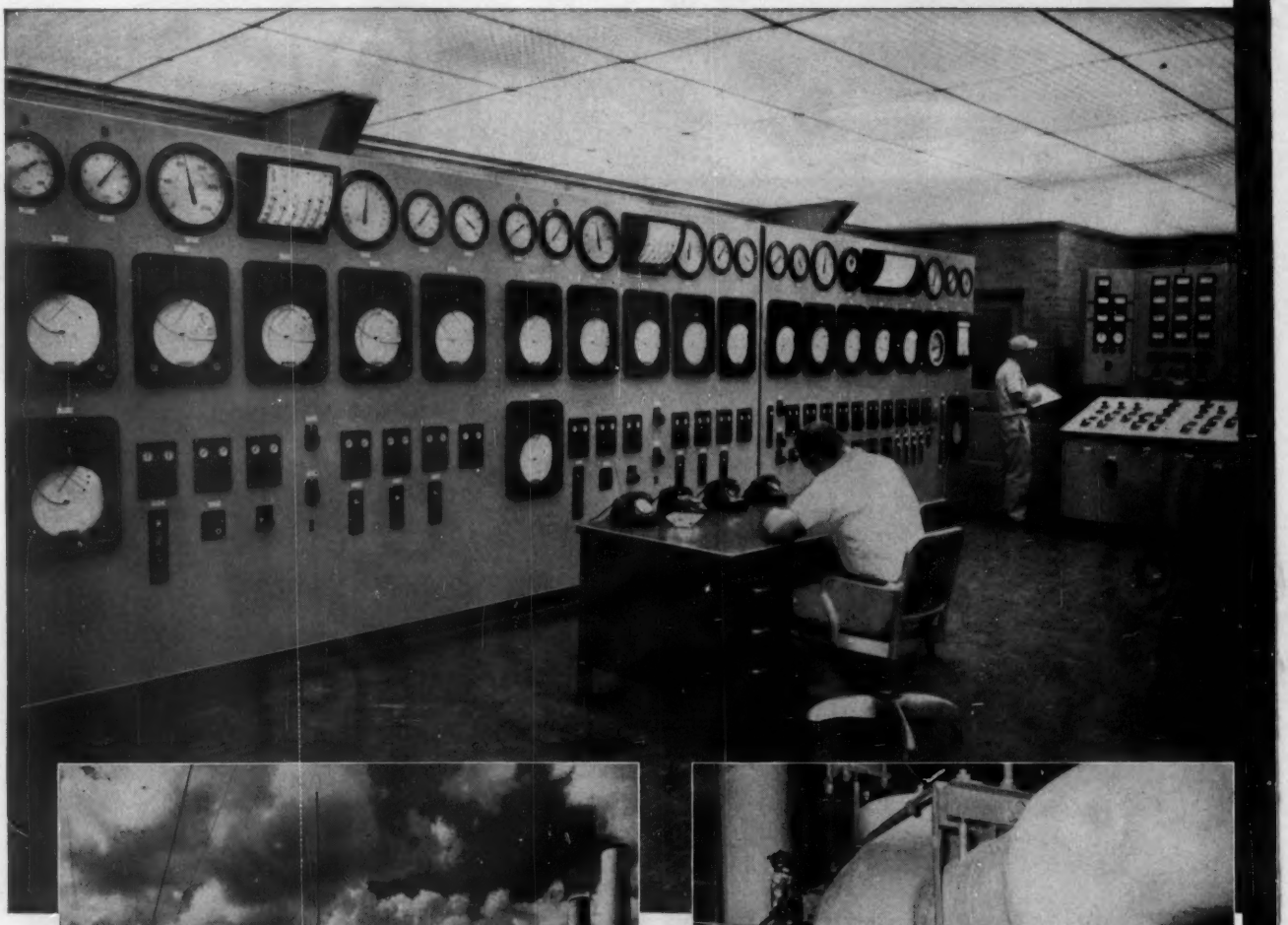
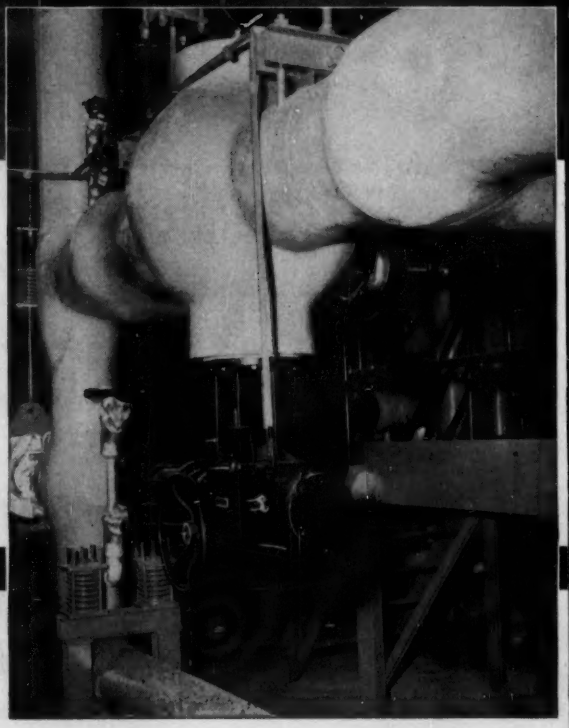
Here's the *1,153rd*





**At Lake Catherine Station,
Arkansas Power and Light Company**

***Above*—Centralized control room for Bailey Controls of Feed Water, Combustion and Steam Temperature.**

***Right*—Bailey Three-element Feed Water Control Valve.**

Installation of . . .

Bailey Three-element Feed Water Control

★ This installation of three-element feed water control at the Lake Catherine Station of Arkansas Power and Light Company is not the latest, the largest, or the most unusual; but it is important to you as a user of power generating equipment.

Here's why: It is a part of the widespread and well founded acceptance of Bailey Three-element Feed Water Control Systems. No other manufacturer can offer you an equal background of experience in this advanced method of feed water control.

Contributing to this overwhelming endorsement are several factors: Not only has the basic principle been proved and re-proved in use, but the design of the equipment has been similarly stabilized and improved. As a result, Bailey has established a reputation for successful operation in difficult installations where other systems have failed. And a twenty-five year backlog of experience has contributed unusual records for accuracy and dependability in operation.

Even more important, the Bailey field engineering service, established in important industrial centers, insures prompt and efficient service and installation supervision regardless of your location. Your local Bailey office will be glad to arrange an inspection trip to a near-by installation of Bailey Three-element Feed Water Control. Give them a call today. And for catalog literature, including a partial list of installations, write for Bulletin No. 105-C.

A-122-2

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1036 IVANHOE ROAD

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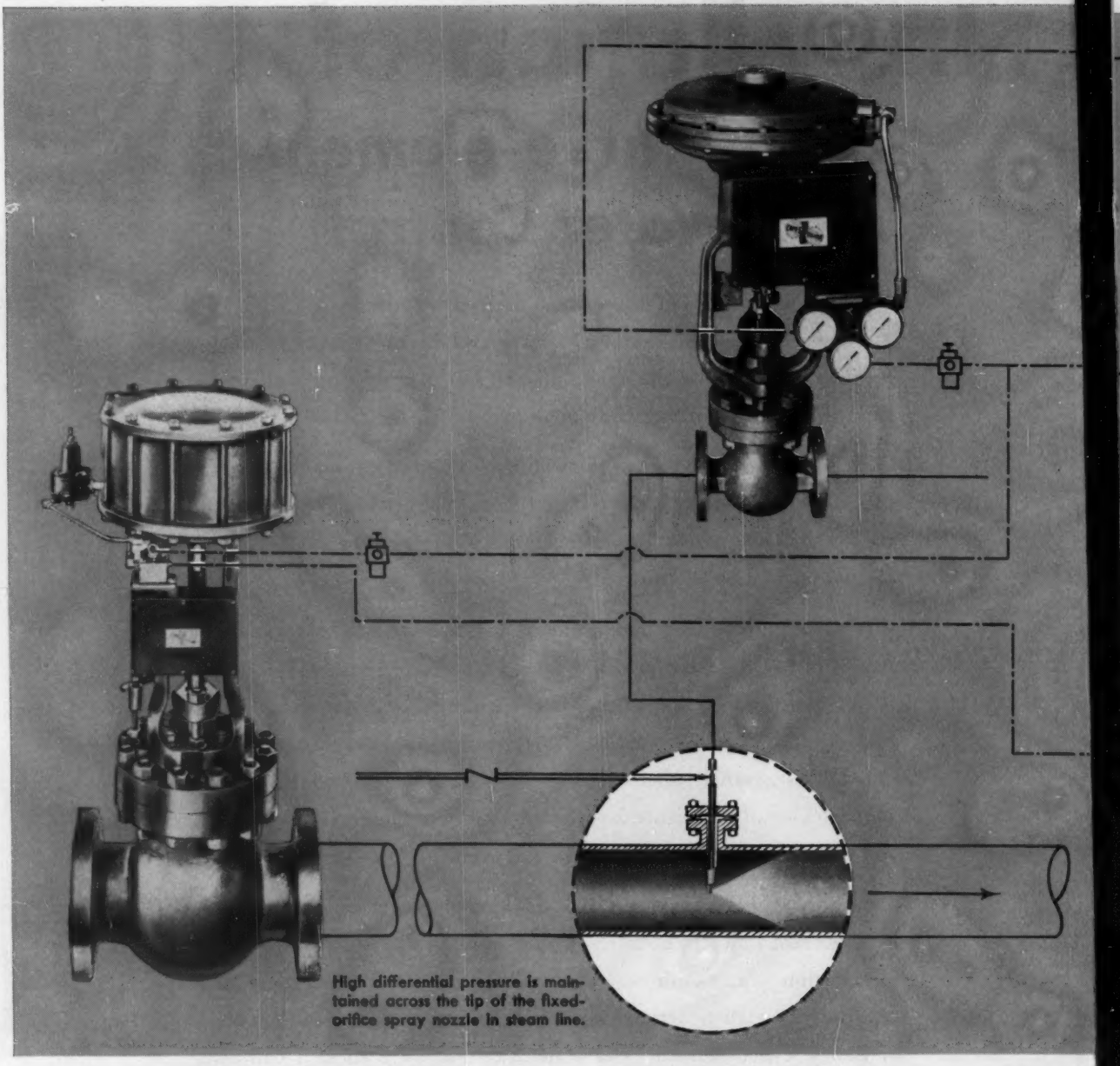
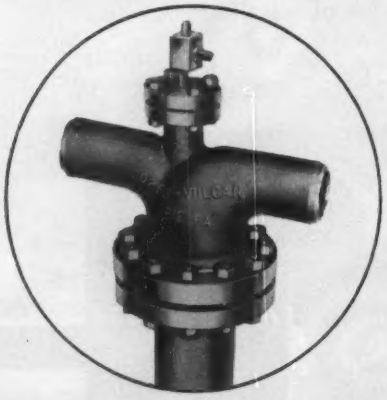
LIQUID LEVEL
FEED PUMPS



High differential pressure is maintained across the tip of the fixed-orifice spray nozzle in steam line.



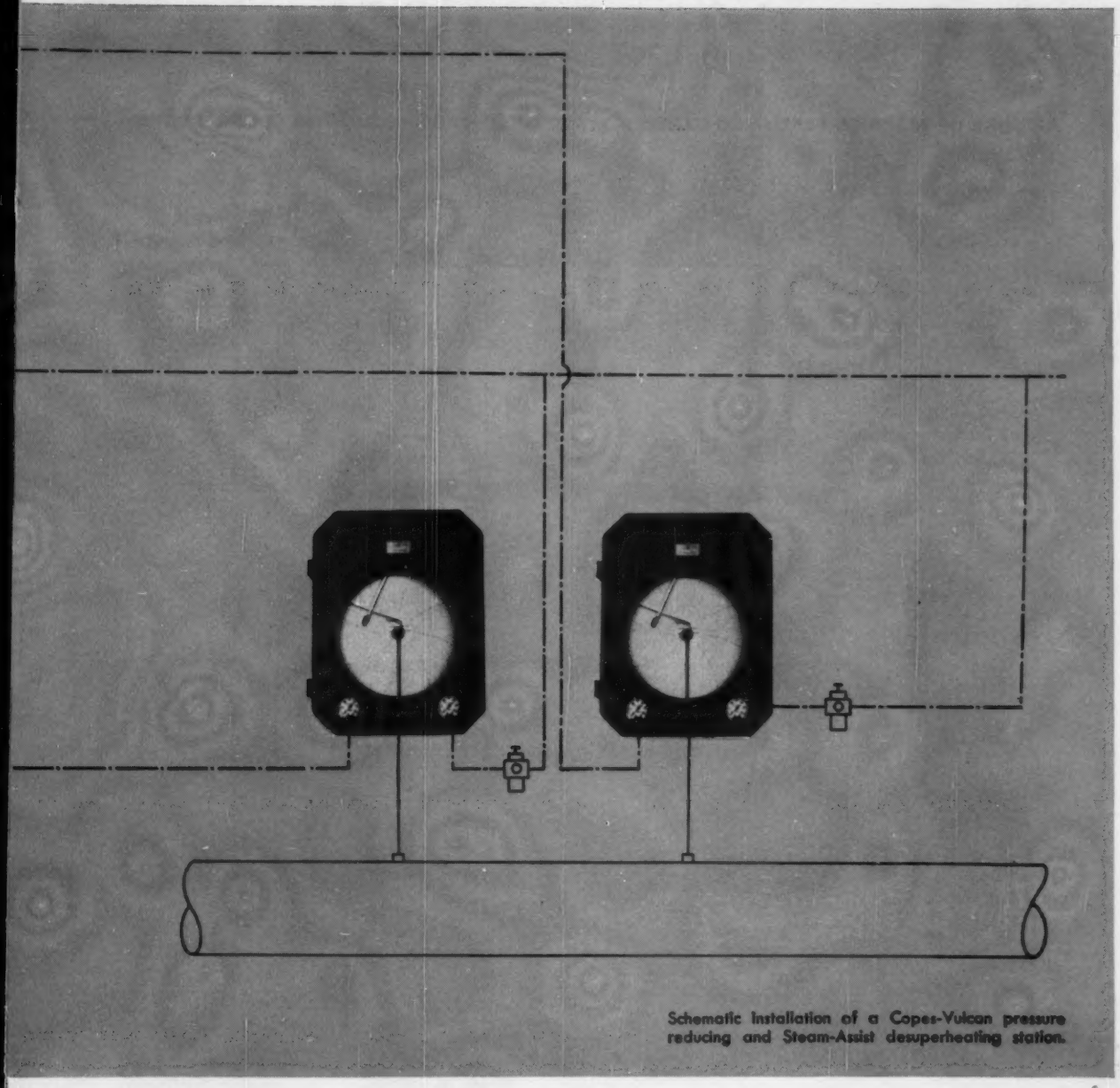
Copes-Vulcan offers in-line or carburetor type Steam-Assist, or simple mechanical-atomizing desuperheaters.

NEW Copes-Vulcan

These high-quality pressure reducing and desuperheating stations offer the latest advances in reducing valves and desuperheaters. They give you an integrated station designed specifically to meet your operating needs.

Copes-Vulcan valves—diaphragm or piston operated, depending on your conditions—give close modulating control. Simplified design means optimum operating characteristics with easy, low-cost maintenance.

The Steam-Assist Desuperheater advances a new principle in reducing steam temperatures. Cooling water and assisting steam are mixed in the exclusive



Schematic installation of a Copes-Vulcan pressure reducing and Steam-Assist desuperheating station.

Pressure Reducing and Desuperheating Stations

swirl chamber, upstream from the point of injection. No large steam bubbles form to cause hammer or vibration. Flow of assisting steam can be automatically reduced as load increases, and shut off completely at high loads where no more than mechanical atomization is needed.

"Packaged" control systems by Copes-Vulcan mean undivided responsibility, custom design and lifetime engineering service. They assure top performance over an unusually long service life.

50th Anniversary
BLAW-KNOX
1906-1956

COPES-VULCAN DIVISION
BLAW-KNOX COMPANY
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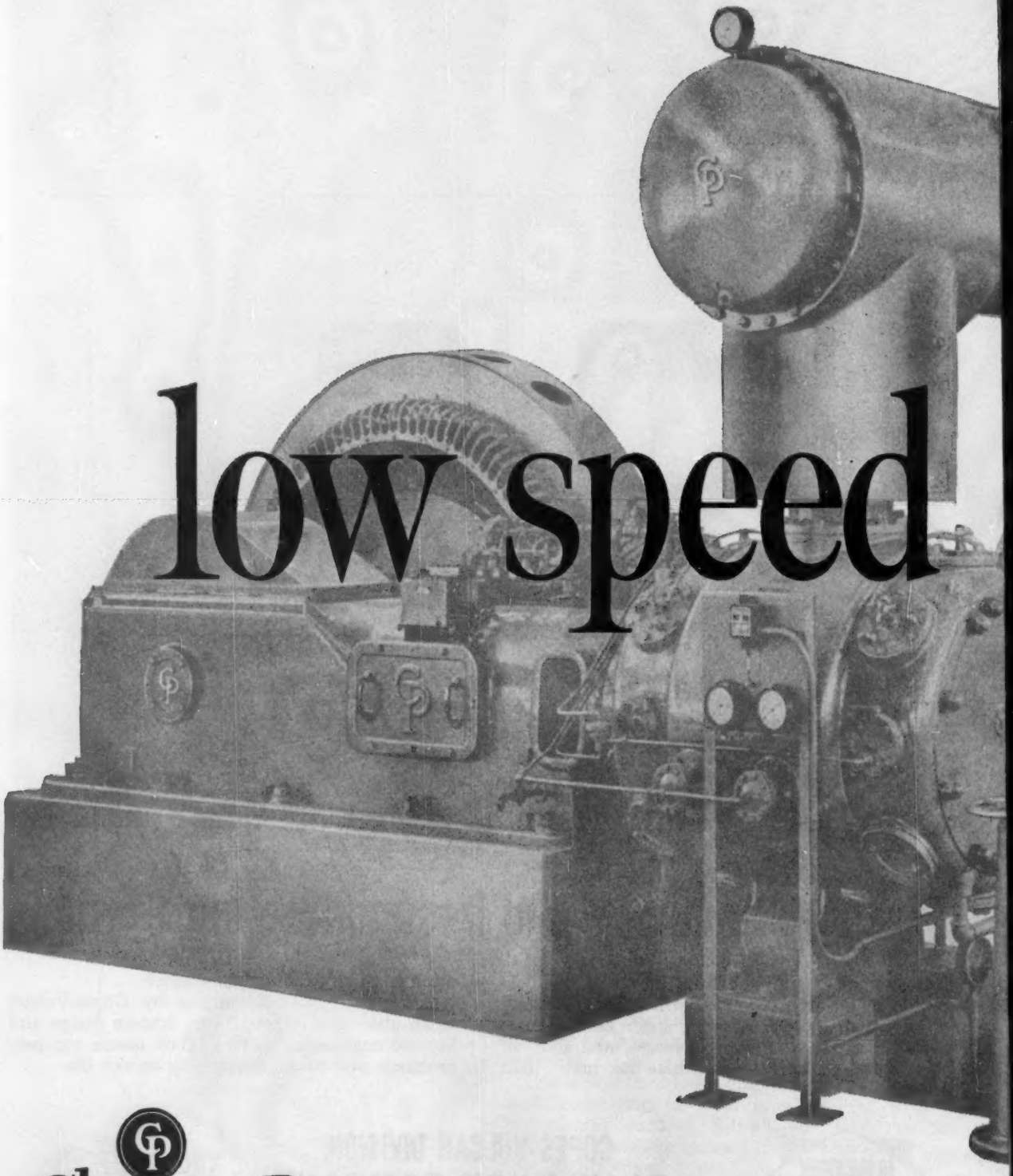
COPES VULCAN

ONE OF A SERIES FEATURING VARIOUS TYPES OF CHICAGO PNEUMATIC COMPRESSORS



low speed

Chicago Pneumatic *8 East 44th Street, New York 17, N. Y.*

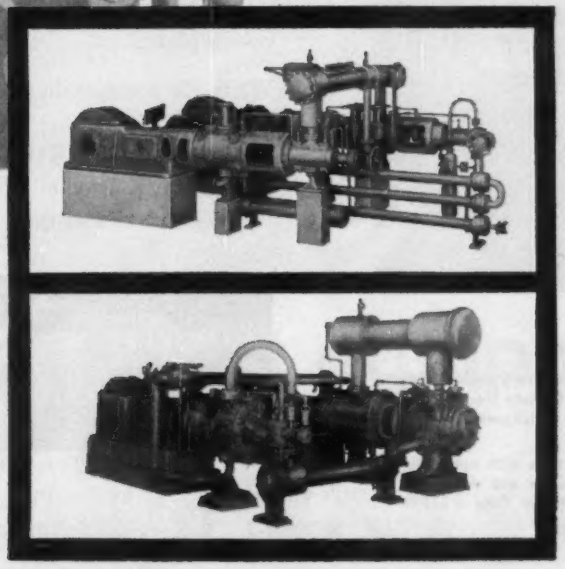
AIR AND GAS COMPRESSORS • VACUUM PUMPS • PNEUMATIC TOOLS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS

Class O compressors

for maximum availability

- **FOR PRESSURES TO 15,000 PSIG**
- **SIZES 200 TO 1000 HP**

(other CP Compressor models available in sizes up to 5000 hp)



Class OCE-5 five-stage, horizontal duplex ethylene gas compressor.

Four-stage Class OCE-4, slow-speed compressor handling hydrogen at 3000 psig.

"this is

● Engineers tell us Yarway Remote Liquid Level Indicators are the most dependable boiler insurance they can have.

Instant . . . accurate . . . brilliant . . . continuous readings of boiler water level are seen on the panel or wherever you wish in your plant. You know the readings are right because they are controlled by the boiler water itself . . . by the pressure differential between a constant head of water and the varying head in the boiler drum. *Indicating mechanism is never under pressure.*

Yarway Indicators may be equipped with a Yarway Control Unit that operates Remote Hi-Lo-Alarm signal lights or horns. For a 24-hour record of boiler water levels, use the Yarway Hi-Lo-Graph Recorder.

On the boiler drum itself you'll want Yarway Water Gages . . . and these "bright as a star" gage readings can now be televised with a Yarway—RCA Television chain.

From drum to panel and at all remote locations, Yarway equipment gives you the safest boiler protection you can buy . . . proved beyond doubt in thousands of power plants.

Write for the specific bulletins you want.

YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES

YARWAY

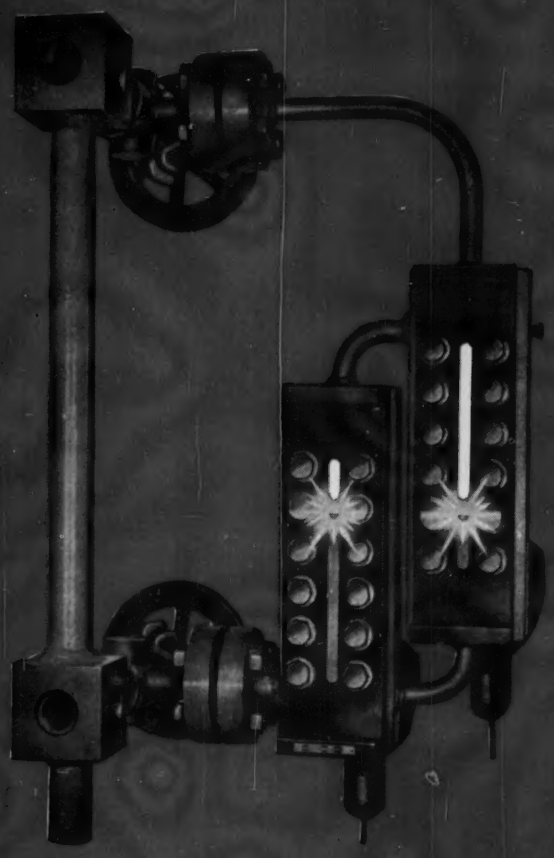
WIDE VISION!

Clear, brilliant readings from any angle, are possible with the "wide vision" face on the Yarway Remote Liquid Level Indicator. Pointer is always visible, even at extreme high and low water levels.

The Yarway Indicator is manometric type with automatic temperature compensation, as approved for use under the ruling of A.S.M.E. Boiler Code Committee in Case # 1155.

Described in Yarway Bulletin WG-1824.

good boiler insurance!"



YARWAY WATER GAGES

Flat glass, high pressure type shown, features new separated-design insert and Type "M" illumination that causes water level meniscus to "shine like a star". Described in Yarway Bulletin WG-1812.

YARWAY REMOTE SIGNAL ALARMS

Lights on horns, operated by Control Unit on Yarway Indicator, give instant warning of any serious deviation from normal water level. Can be located anywhere in plant. Described in Yarway Bulletin WG-1824.

YARWAY HI-LO-GRAPH RECORDER

Gives a continuous 24-hour record of liquid levels. Activating mechanism is same as in Yarway Indicator. Used both for indicating and recording. Described in Yarway Bulletin WG-1830.

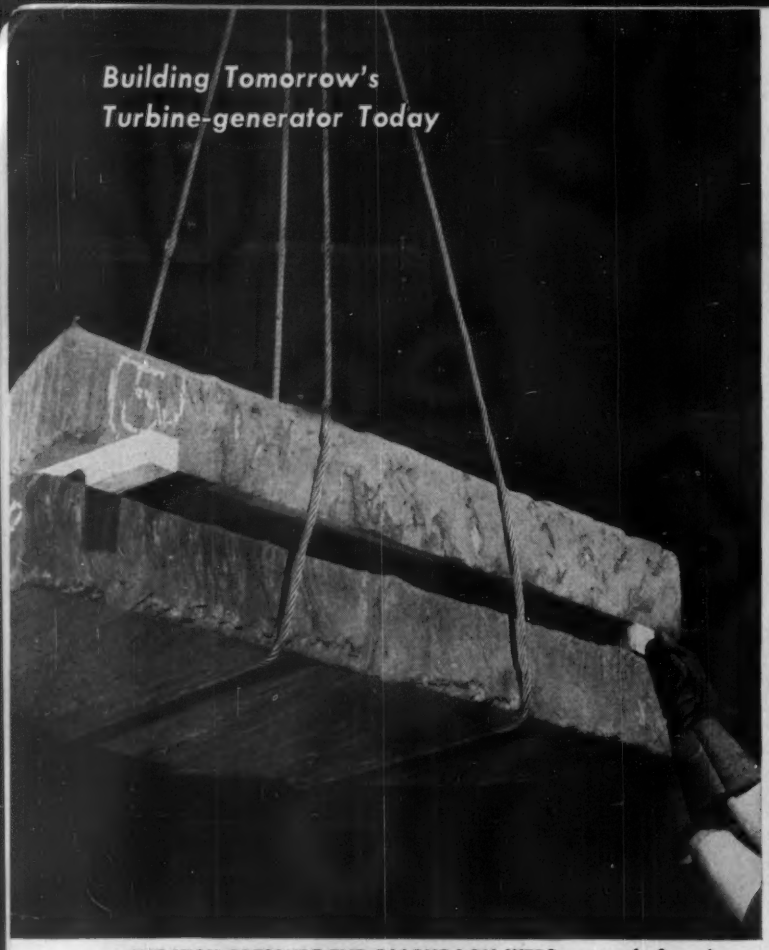
YARWAY RCA TELEVISION

Simplified system consists of compact camera and panel-mounted monitor. Clear, bright image of water level gage anywhere in the plant.
Described in Yarway Bulletin WG-1813.

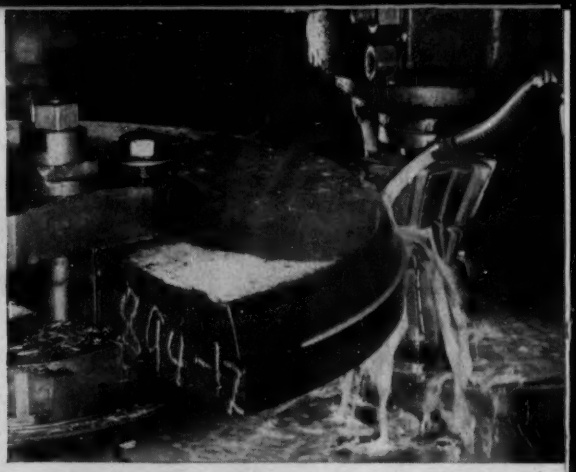
steam plant equipment

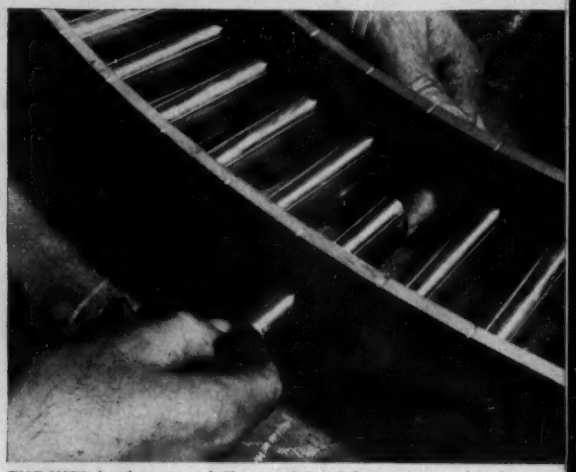
Blow-Off Valves	Steam Traps
Water Columns and Gages	Strainers
Liquid Level Indicators	Spray Nozzles
Expansion Joints	Digester Valves

Building Tomorrow's Turbine-generator Today



THE HIGH-PRESSURE END DIAPHRAGM WEBS are made from heavy alloy steel plates or castings. Some are ten inches thick and can withstand high pressure drops and maintain close clearances.



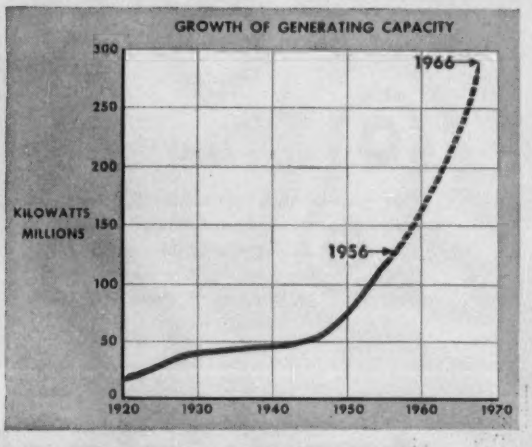


THE WEB is then carefully machined for welding (top). Nozzle partitions are machined from solid chrome-iron alloy and assembled in punched bands (bottom).

How General Electric builds sturdy nozzle-

GENERAL ELECTRIC MAINTAINS a continuing program of research on turbine diaphragms. This smoke tunnel provides a visual indication of how steam flow will follow new nozzle designs.

TO MEET TOMORROW'S EXPANDING LOADS



G.E. works with electric utilities and consulting engineers in these vital turbine-generator areas:

BASIC RESEARCH

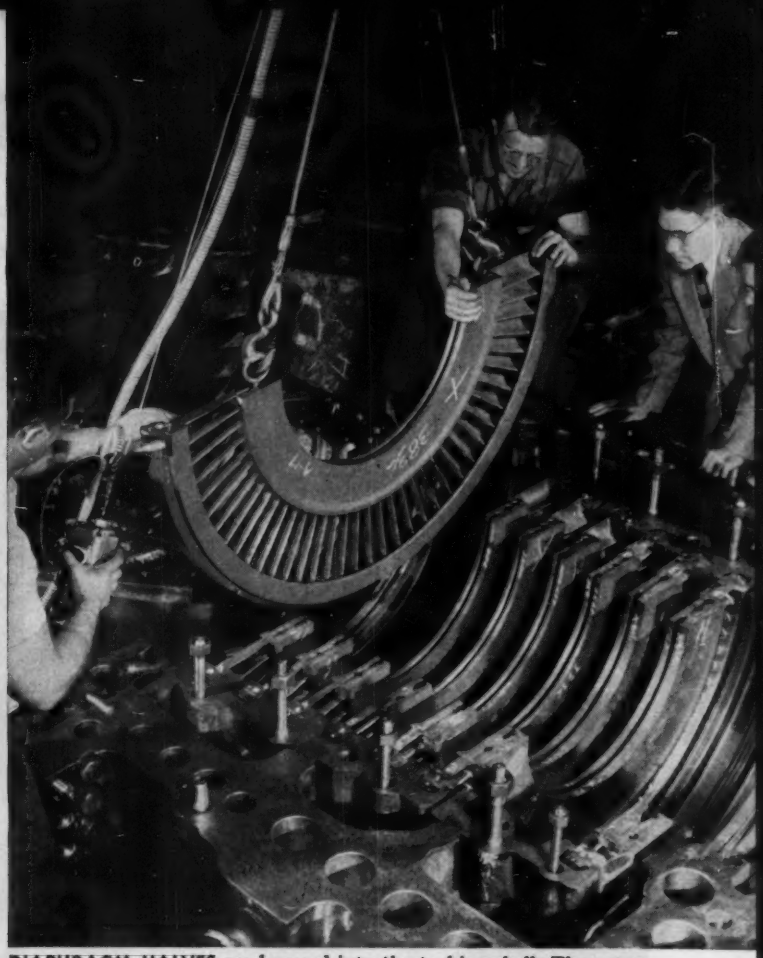
APPLIED RESEARCH

PRODUCT DEVELOPMENT: NOZZLE-DIAPHRAGMS

TESTING

MAINTENANCE

THIS NOZZLE assembly is welded to the web and outer ring (top). A finishing operation puts a high polish on the partitions for a smooth steam path (bottom).



DIAPHRAGM HALVES are lowered into the turbine shell. The rotor is then assembled and the upper shell containing the top half of the diaphragm is added to form a series of complete compartments.

diaphragms to reduce turbine maintenance

TOUGH CONSTRUCTION HELPS PROTECT STEAM PATH AGAINST DESTRUCTIVE FOREIGN MATERIALS

Internal damage to the steam path can be a costly and time consuming cause of turbine shutdown. Should large amounts of foreign material enter the steam path whole rows of buckets and partitions might be severely damaged. This could mean a long and costly outage.

TO HELP GUARD against a long outage, General Electric builds turbine nozzle-diaphragms of tough, sturdy construction. And here's how they help. Should foreign materials enter the steam path, these rugged nozzle-diaphragms "compartmentalize" damage to a small area. This greatly simplifies bucket repairs or replacement.

GENERAL ELECTRIC MANUFACTURES these diaphragms from solid castings or plates carefully machined to shape. Nozzle partitions are machined from solid chrome-iron alloy and welded to, or cast integral with, the webs. These partitions must direct the steam flow at the proper angle and velocity to the adjacent buckets.

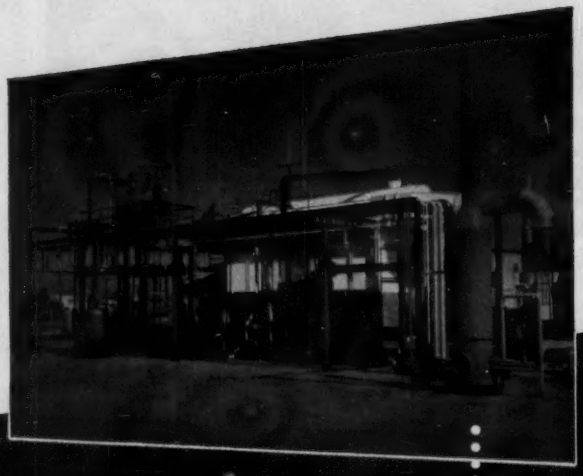
In this and many other areas of research G.E. is working with electric utilities and consulting engineering firms to design the power makers for tomorrow's load growth. For more information on General Electric turbines write for GER-905, Large Steam Turbine-Generator Department, General Electric Company, Schenectady 5, N. Y. 254-40

Progress Is Our Most Important Product

GENERAL ELECTRIC

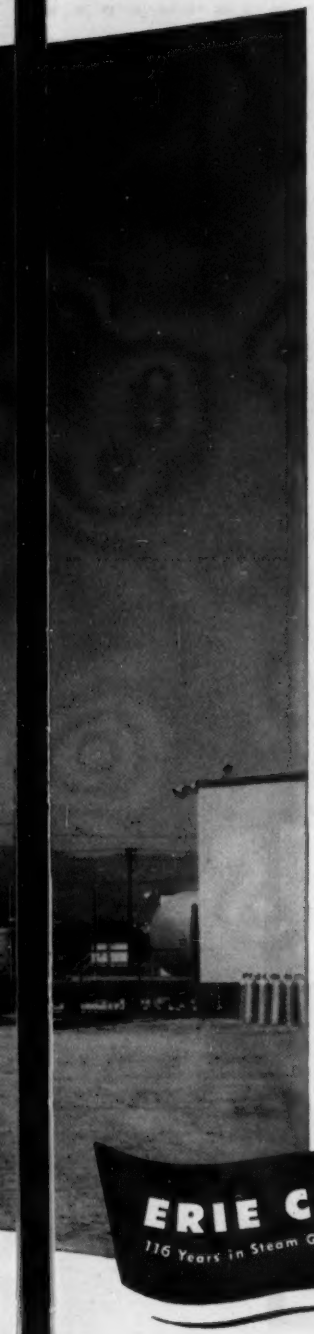
Everything depends on

ERIE CITY VL
selected because of its high ---
CO_2 flue gas



--the boiler flue gas ~ at this $1,500,000 Liquid plant

Liquid Carbonic Corporation, world's largest producer of CO_2 in liquid, gas and dry ice forms, operates the world's most automatic processing plant, of its kind, at Oakland, California



• Boilers used in the manufacture of dry ice and liquid CO_2 are specially designed and are an integral part of the process. When Liquid Carbonic specified the quantity of CO_2 to be produced at its Oakland, California plant, Erie City engineers met their stringent requirements. They designed and built the boiler, holding excess air to a minimum, while insuring complete combustion to obtain a high CO_2.

The entire operation at this plant is dependent upon the quantity of CO_2 that leaves the boiler. Unlike other boilers, steam production in this VL is incidental but is fully utilized to power the process.

Liquid Carbonic Corporation has for years found Erie City boilers dependable in this unique, severe application. The Oakland, California installation is one of many with Erie City boilers.

You, too, can depend on Erie City for sound engineering. Whatever type of steam generator you require, remember that Erie City designs and manufactures the most complete line, including all major components, to offer one single responsibility. There's over 116 years of experience to serve you.

If you would like the complete story on the Erie City VL write for SB-433.

ERIE CITY
116 Years in Steam Generation

You can depend on Erie City for sound engineering

ERIE CITY IRON WORKS • *Erie, Pa.*

STEAM GENERATORS • SUPERHEATERS • ECONOMIZERS • AIR PREHEATERS
UNDERFEED AND SPREADER STOKERS • PULVERIZERS

Now to supply **both** Power

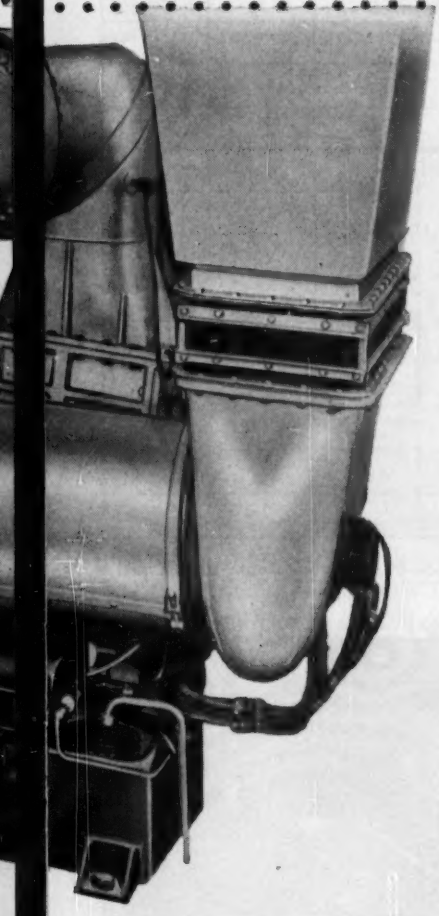
Clark introduces

Mark TA Features

Quick starting—2 minutes to full load
Quick shutdown—instantaneous—no turning gear
Field proved—forty units delivered
Light weight—less than 6 tons
Compact—only 16′ long, portable
Long life—conservative blade temperatures
Air cooled—long life—cool outer surface
Packaged—shipped assembled, ready to install
Fuel versatility—liquid or gaseous
Installation flexibility—up or down duct connections
Variable speed—physically separated turbines
Single combustion chamber—lasts a lifetime

and **Steam**

the **Mark TA** Gas Turbine



Power to drive a generator, pump or centrifugal compressor and low or high pressure steam for process use . . . the new Clark Mark TA 1130 bhp gas turbine will do both when equipped with a waste heat boiler. In addition to the 1130 bhp of rotative energy the turbine-boiler package will deliver 9500 lbs. of steam per hour at a combined fuel utilization of up to 79%. It's the most modern, compact and efficient power plant combination you can install!

The new turbine is also well suited to driving rotative loads without a waste heat recovery system. Its light weight, compactness and quiet, practically vibrationless operation makes it ideal for marine or portable use as well as for permanent installation.

Your nearest Clark representative will be pleased to give you all the facts about Clark gas turbines in sizes to 8500 bhp, or write for bulletin 142.

CLARK BROS. CO. OLEAN, NEW YORK

One of the Dresser Industries

Offices in Principal Cities Throughout the World

CLARK®

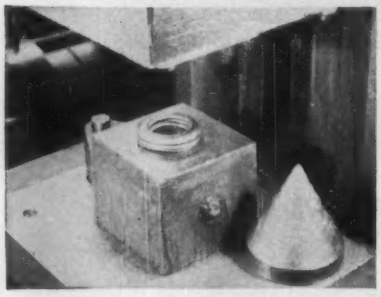
ONE OF THE DRESSER INDUSTRIES

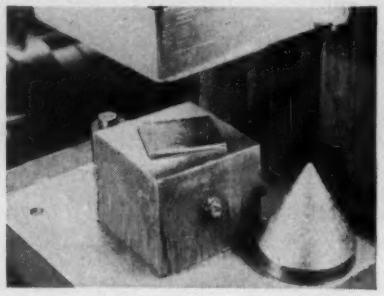
Gas Turbines

These extras make ELECTRUNITE

	TESTS	ELECTRUNITE BOILER TUBES	ASTM A-178 ASME SA-178	ASTM A-226 ASME SA-226	A.A.R. M-108	SEE NOTE*	FEDERAL WW-T-731b	MIL-T-17188	MIL-T-20160	MIL-T-20162 MIL-T-20169
Before Welding	Chemical Composition	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Gage Check	✓								
Production Control	Flattening	✓								
	Reverse Flattening	✓								
	Expansion	✓								
	Flange	✓								
	Metallurgical Laboratory	✓								
Finished Tube	Flattening	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Flange	✓	✓	✓	✓	✓	✓	✓		
	Crush	When Required	When Required		When Required	When Required				
	Reverse Flattening	✓	✓	✓		✓				
	Tensile	✓							✓	✓
	Hydrostatic	✓	✓	✓	✓	✓	✓	Optional	✓	✓
	Non-Destructive Electric	When Required	In lieu of Hydrostatic	In lieu of Hydrostatic			In lieu of Hydrostatic	All or part required		Optional
	Final Inspection	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Protective Coating	✓					✓	✓		

*NOTE: Tests in this column specified in American Bureau of Shipping, Sec. 40 par. 66-83; Treasury Dept., U. S. Coast Guard-Marine Engineering Regulations 51.01, 51.25, 51.28, 51.34.





THESE TESTS ARE TYPICAL of those listed in the chart above, showing: 1, axial crush test; 2, flatten test with weld at point of maximum bend; 3, hydrostatic test of each completed tube, at a pressure in excess of code requirements.

REPUBLIC

REPUBLIC STEEL

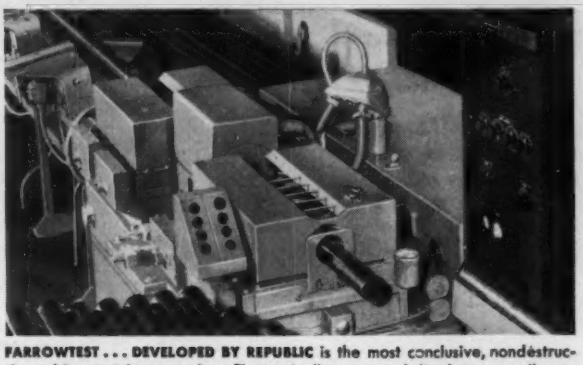
World's Widest Range of Standard Steels

...the most thoroughly tested tubing you can buy

Let's face the facts: the true test of boiler tubing is its performance in actual service . . . but you have to know the results before installation. That's why Republic ELECTRUNITE® Boiler Tubes are your best choice, whether you are installing a new boiler or retubing an existing unit. ELECTRUNITE, the original electric resistance welded tubing, is backed by more than a quarter century of manufacturing experience plus the most thorough quality control and testing program in the world.

This program assures quality from raw ore to finished product and includes not only all tests required by applicable specifications (see chart), but *complete production control tests* during manufacture, as well. In addition, Republic alone offers FARROWTEST®, the electronic nondestructive test, which, when you specify it, peers *inside* your tube walls to detect and reject any flaws. Republic quality, verified by FARROWTEST, will meet the strictest specifications. It is your best evidence that ELECTRUNITE Boiler Tubes, when properly installed and maintained, will give years of dependable, trouble-free service.

On your next order for boiler tubes, get the best. Get Republic. Just call your local Republic representative or mail the coupon for further information.



FARROWTEST . . . DEVELOPED BY REPUBLIC is the most conclusive, nondestructive tubing test in use today. Electronically operated, its detector coils can spot defects in tube walls which would be hidden from routine test procedures. You can specify FARROWTEST on ELECTRUNITE Boiler Tubing instead of your present method at no extra cost.

UNIFORMITY IS THE KEY to easier, faster installation when you use ELECTRUNITE Boiler Tubes. They slide into headers and drums easily, expand evenly with less rolling, and bead over quickly. Republic manufacturing methods "build-in" uniform wall thickness, diameter, strength, ductility, microstructure and surface. Testing verifies these characteristics in each tube you receive.

REPUBLIC STEEL CORPORATION
3144 East 45th Street • Cleveland 27, Ohio

Please send me more information on:

☐ ELECTRUNITE Boiler Tubes
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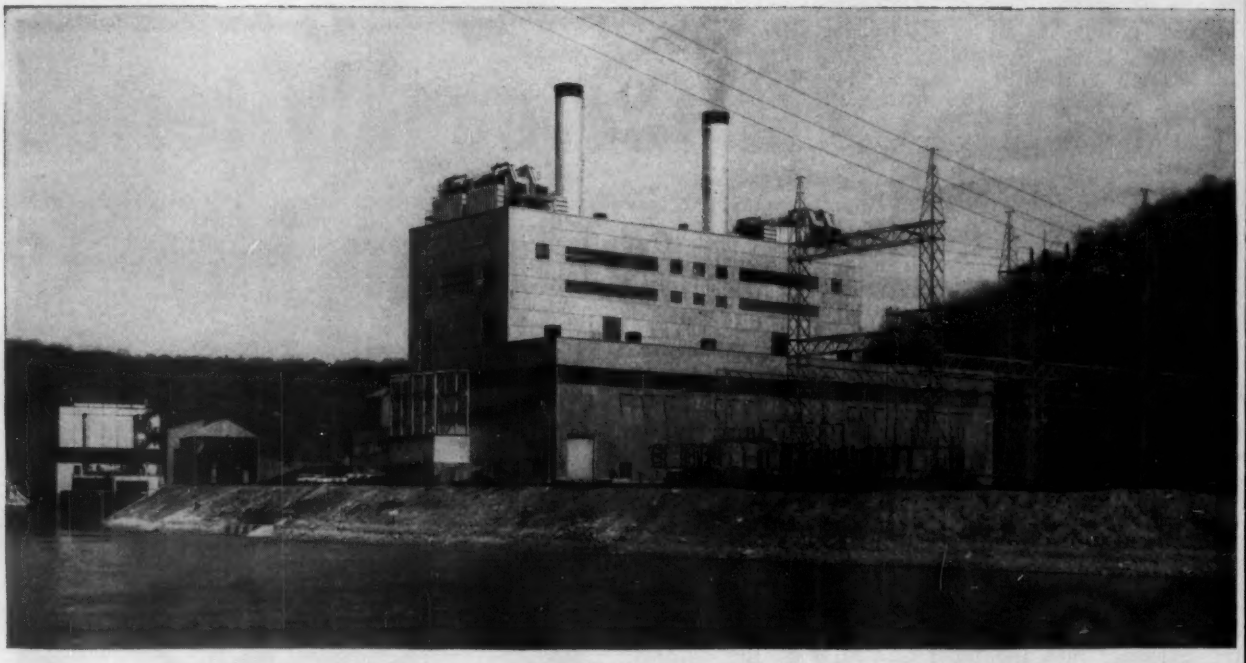
STEEL

and Steel Products



Shawville Station, Pennsylvania Electric Company — Gilbert Associates, Engineers. Boiler plant consists of two 894,000 lbs. per hour coal fired reheat units operating at 1900 psig and 1055°F/1005°F.

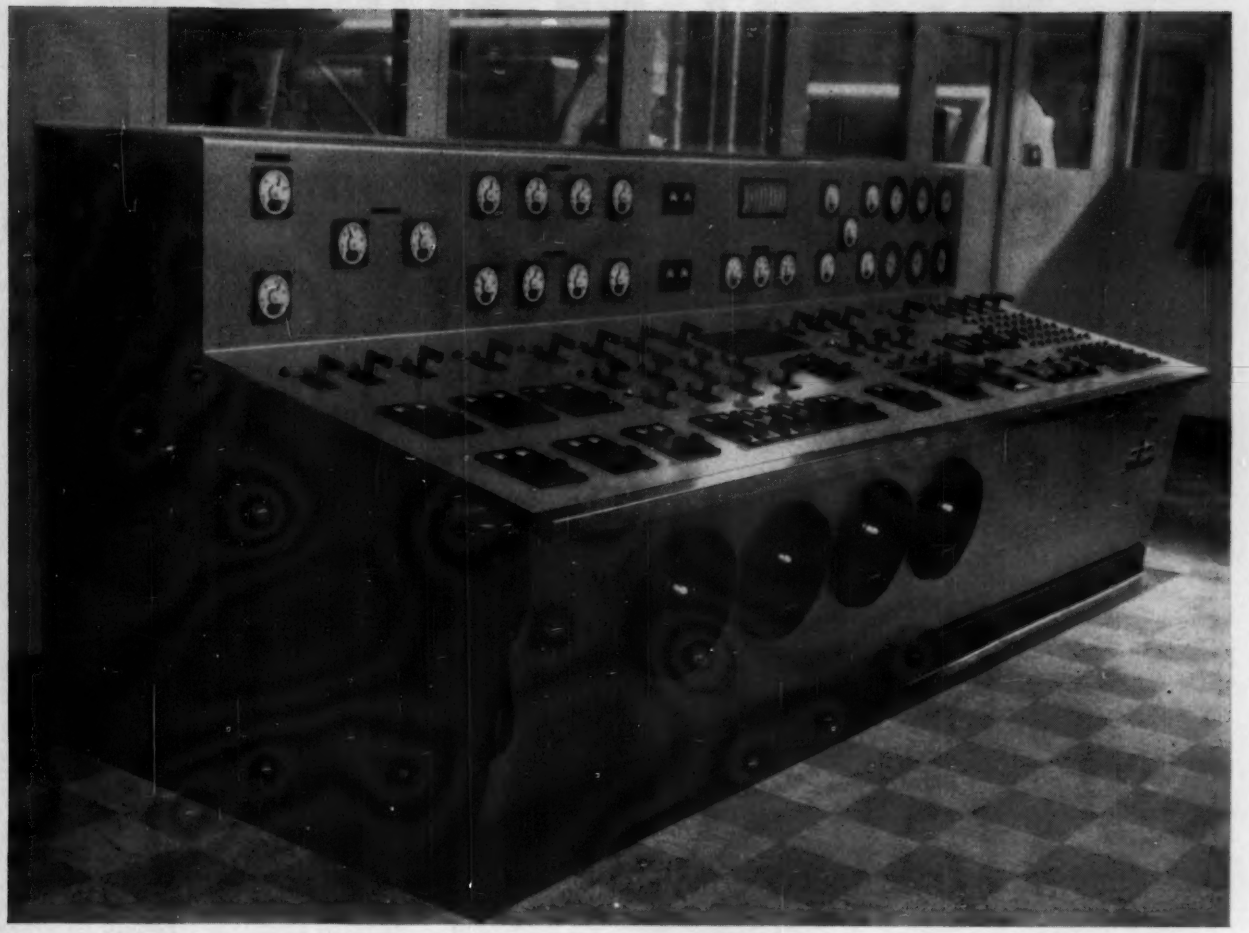
SHAWVILLE
Controls Steam Costs *Electronically*

At Pennsylvania Electric's new central station near Clearfield, Pa., Republic Electronic Combustion Controls instantaneously correct the firing rate when load changes *first* occur — minimize the effect of load swings almost to the vanishing point —simplify feedwater and steam temperature control—eliminate practically all mechanical inertia, friction and lost motion in master control apparatus—transmit control signals with the speed of light—permit more compact, easier-to-operate control panels.

These electronic combustion control features are paying off in lower steam costs for Shawville. In fact, this station produces steam at such low cost that it is able to compete successfully in out-of-state areas over 250 miles away.

At Shawville, electronic circuits instead of pneumatic and mechanical assemblies generate control impulses which are sent to pneumatically powered regulators on boiler auxiliaries. Dead spots and time lags in the master control system due to mechanical lost motion, friction and inertia are almost completely eliminated. And control impulses are transmitted practically instantaneously, thanks again to the speed of electronics.

REPUBLIC FLOW METERS CO.



Electronic combustion controls for Unit No. 2 at Shawville are centralized on this benchboard.

The master impulse for the combustion control system is derived from steam flow. Air flow to the boiler is directly controlled by this impulse. The signal is then modulated by pressure changes in the steam header and sent to coal mills. Variations in the fuel are automatically compensated for. If steam flow falls below or exceeds pre-set limits, the steam flow-air flow control system is automatically blocked out and conventional fuel flow-air flow control substituted.

This control system compensates for load changes so quickly that their effect on boiler operation is practically nullified. Optimum fuel-air ratio is maintained continuously for maximum combustion efficiency. The feedwater system and superheater temperatures are also stabilized, making these quantities easier to control.

REPUBLIC

Automatic

COMBUSTION CONTROLS

(Pneumatic or Electronic)

★ for all sizes and types of boilers
★ for all methods of fuel firing
★ for all load conditions
★ for all arrangements of draft

Write for full details

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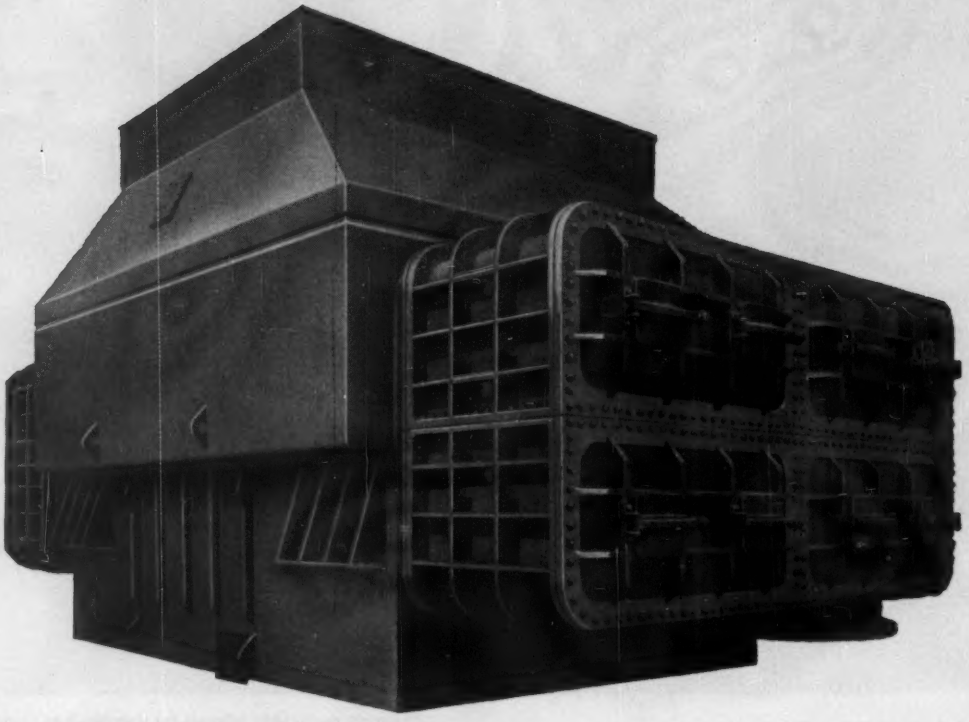
SUPERIOR

of I-R condenser design



I-R space-saving surface condenser sets the pace in steam plant practice

FOR YEARS Ingersoll-Rand condensers have made possible a new concept of condenser design and efficiency. Incorporating controlled longitudinal steam distribution and graduated tube spacing, all I-R condensers feature an ultra-compact arrangement of internal elements in a rectangular shell. This permits maximum utilization of the condenser space available.

Continual refinements in design are contributing to ever smaller space requirements for a given condensing capacity. These developments conform with the modern trend to higher turbine efficiencies and more compact turbine designs in reduced foundation areas for a given kw rating.

The I-R rectangular design permits varying the ratios of length, width and height without sacrificing condenser performance. Dimensional proportions can be changed over wide limits without departing from the basic standard arrangement of internal elements.

These advantages help make I-R condensers the most efficient available today — readily adaptable to all steam plant requirements. Your I-R engineer will be glad to give you further information.

4-445

Ingersoll-Rand

11 Broadway, New York 4, N.Y.

COMPRESSORS • TURBO-BLOWERS • ROCK DRILLS • AIR TOOLS • CENTRIFUGAL PUMPS • CONDENSERS • GAS AND DIESEL ENGINES

ADAPTABILITY

meets today's needs for all turbine-condenser arrangements

BOTTOM EXHAUST TURBINE

Regardless of headroom limitations, I-R surface condensers permit effective utilization of the space available. The sketch above represents a condenser of 65,000 sq ft, serving a 135,000 kw turbine. It requires a headroom of only 14 feet 8 inches. Maximum economy of installation, operation and maintenance is assured. The extreme versatility of the I-R condenser helps meet the widest range of modern steam plant requirements.

SIDE EXHAUST TURBINE

Mounted on the turbine floor, this Ingersoll-Rand condenser is integrated into the advanced design of a huge generating unit serving a large mid-western utility. The twin condenser shells are directly connected to the dual side exhausts of the cross-compound steam-turbine. In this way, the condenser can be selected for the most economical design proportions without regard to the usual limitations of headrooms and other space consideration. The entire condensing surface is above the operating floor.

AXIAL EXHAUST TURBINE

Another outstanding example of I-R adaptability is afforded by this condenser that connects directly to the exhaust of an axial flow exhaust turbine. The condenser unit is of the single-pass rectangular type, with divided water boxes. The result of close cooperation between I-R engineers and the turbine designers, it marks an important step forward in modern steam plant practice.

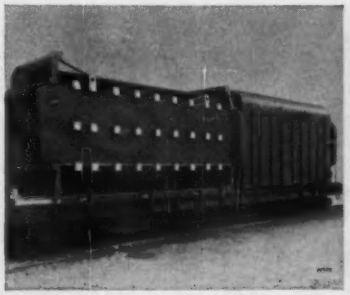
Another cost-saving feature of I-R condensers!

FACTORY ASSEMBLY AND FLANGED CONSTRUCTION

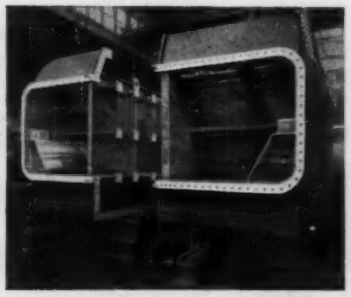
reduce field-fitting and erection welding

Every I-R condenser is assembled at the factory. Then it is disassembled and shipped in sections. Mating surfaces of the shell are machine-flanged, aligned and dowelled.

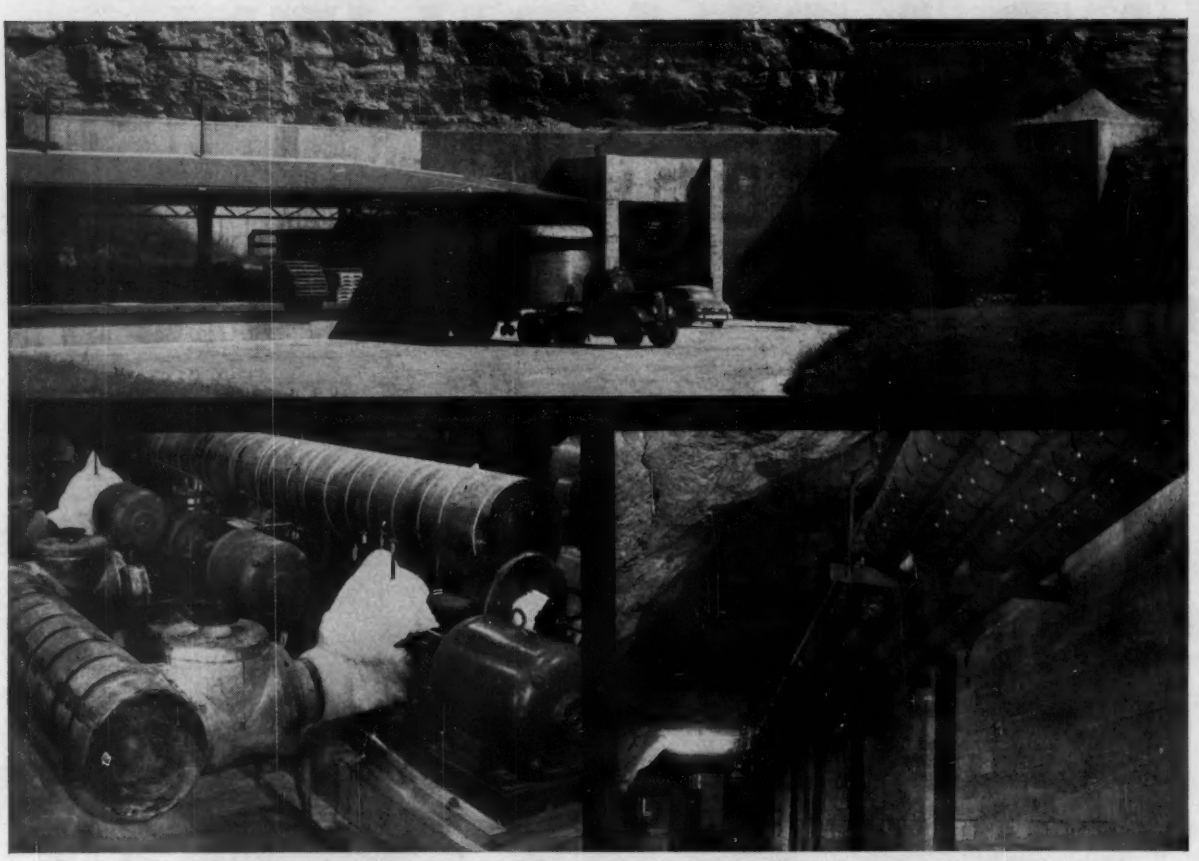
When the condenser arrives at the customer's plant, the shell sections are easily realigned and bolted together. This quality control feature is another reason why I-R condensers cost less to install.



Mounted in sections on railway car, this condenser is going to customer's plant. When erected, all parts will line up perfectly



Full flanged joints and bolting pads of internal bracing on this condenser reduce field-fitting and welding



The 10-inch brine pipe, encased in foamglass, which carries cooling solution to the storage rooms. Notice frost on pumps.

Quadruple section of brine pipe passing through one of the cold storage rooms.

NATIONAL SEAMLESS PIPE

circulates brine and ammonia for refrigeration system of Kansas City Cold Storage "Cave"

Eight miles west of Kansas City, on the main line of the Santa Fe Railroad, is one of the most remarkable cold storage warehouses in the world. It is Inland Cold Storage Company's 100-acre "cave" carved out of solid limestone. Twenty years of mining rock from a 450-acre quarry created this huge "building" inside a hill.

In 1954, the vast area was fitted with a 400-ton ammonia-brine refrigeration system and turned into a "storage-in-transit" warehouse for frozen products. Located in the heart of the nation, it permits a food producer from practically anywhere to stop his shipment in transit, and store it at Inland until he determines which destination is the best market for his product. Thus, a West Coast vegetable producer can quick-freeze his pack, ship it to Inland, and wait for a good market to open up in the East, Midwest, or South; and when it does, he is five days closer to it than his West Coast competitors. Total capacity of the warehouse is 2,500 carloads of frozen merchandise.

Over three miles of National Seamless Pipe, ranging in size from ⅜-inch to 10-inch diameter, were used in the 40-unit refrigeration system. The pipe network circulates brine at minus 24°F., and transmits ammonia which chills the brine. Operating pressures vary from 30 lbs. psi to 120 lbs. psi. Temperatures range from 165°F. to minus 40°F.

Tough service? Sure! But not too severe for National Seamless. That's because every section of National Seamless is pierced from a solid billet of steel, giving it the strength, uniformity and dependability of a solid forging. Each length is an homogeneous steel cylinder with uniform wall strength throughout, designed to remain structurally sound under high temperatures and high pressures. It's tailor-made for tough service.

For full information on the use of National Seamless for power applications, send for Bulletins 10 and 26. Write to National Tube Division, United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa.

NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.

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USS

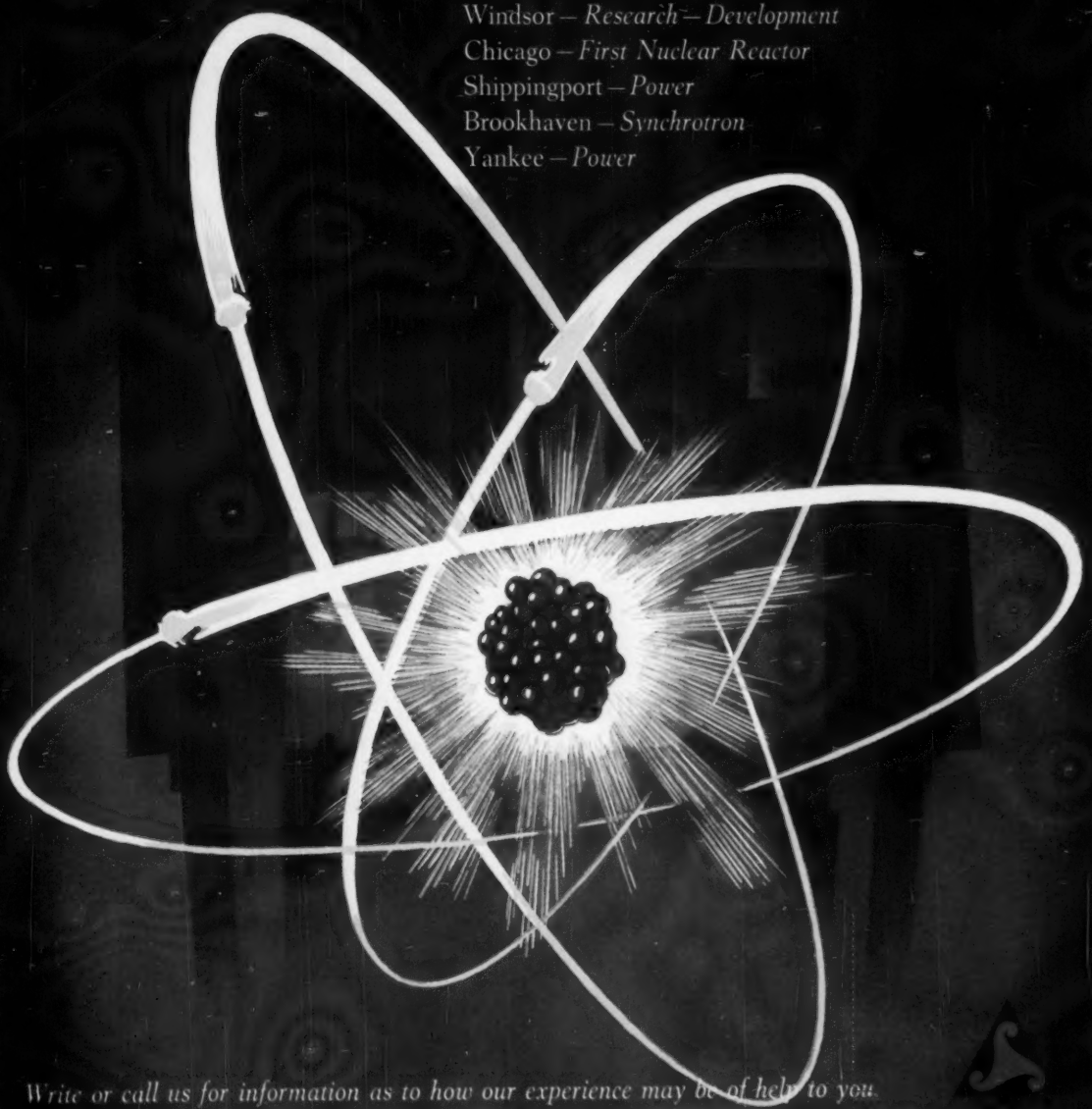
NATIONAL Seamless PIPE AND TUBES

WALLS WITHOUT WELDS

UNITED STATES STEEL

From the inception of nuclear engineering at Stagg Field, Chicago, to current power and research installations, Stone & Webster Engineering Corporation has been engaged in engineering and construction for nuclear projects.

Trail — *Heavy Water*
Oak Ridge — *U235*
Fort Belvoir — *Power*
Windsor — *Research — Development*
Chicago — *First Nuclear Reactor*
Shippingport — *Power*
Brookhaven — *Synchrotron*
Yankee — *Power*



Write or call us for information as to how our experience may be of help to you.

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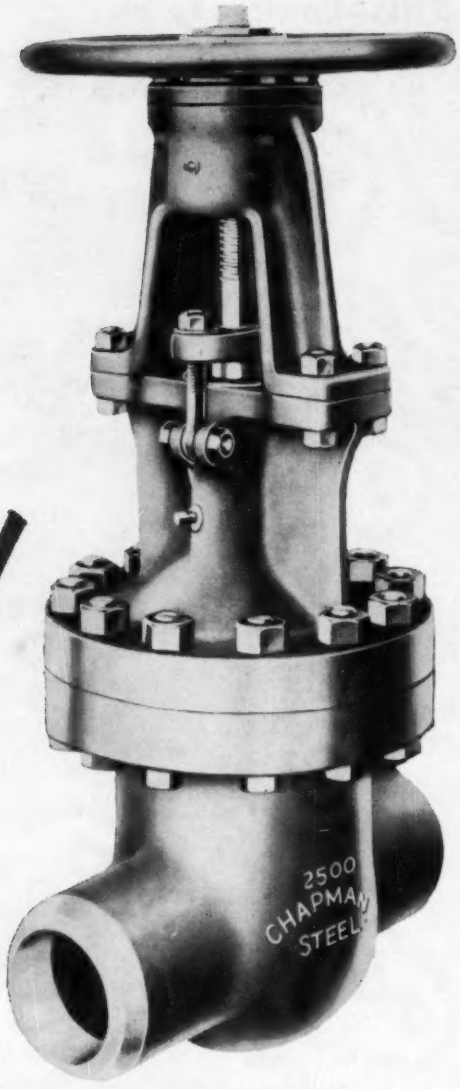
Chapman Steel Valves

Have It!



EVERYTHING YOU NEED

You want steel valves that will prove their metal under tough and varied conditions.

Chapman has them. Steel valves . . . in many different alloys . . . all carefully formulated and poured under rigid supervision in Chapman's own foundry.

You want steel valves with the smoothest operation for years of rugged service.

Again, Chapman has them. Valves that seat tightly, accurately, permanently. Valves that don't jam, chatter or wear excessively. Valves with the closest possible tolerances.

Just name your steel valve requirements. Pressure and temperature for any specified operating condition are met as you want them with Chapman Steel Valves. This includes Chapman welded, pressure seal, bolted bonnet, or valves of special design.

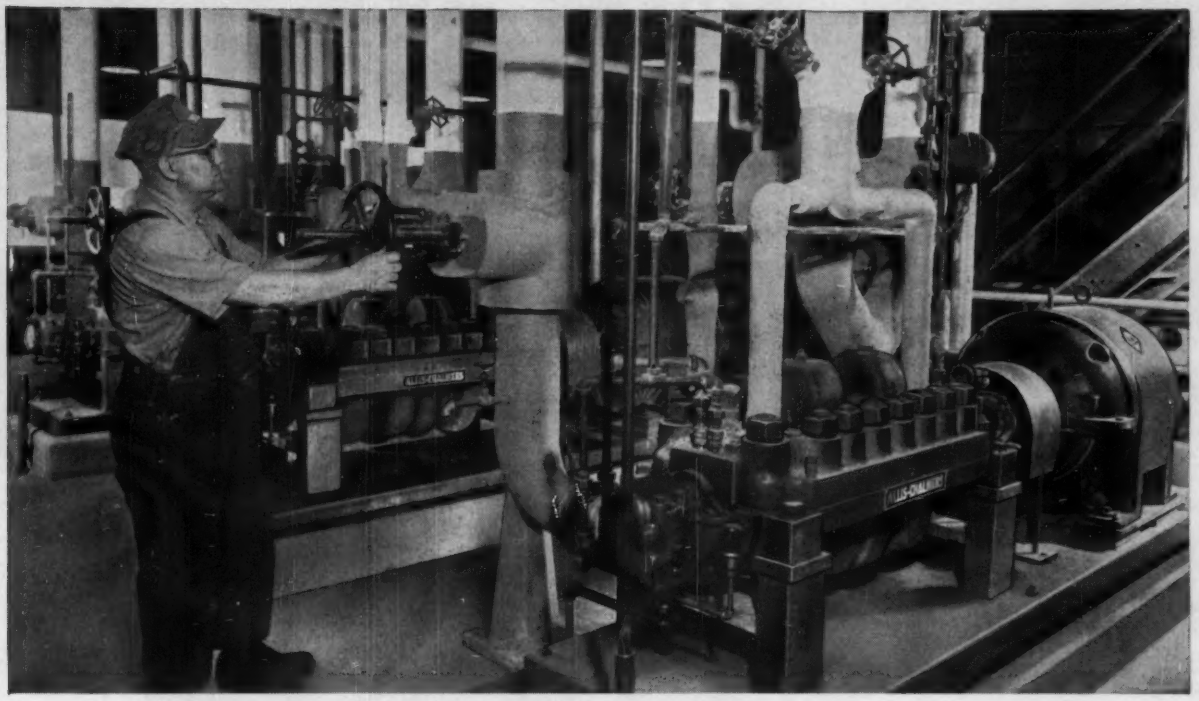
They all equal or exceed A.S.A. and A.P.I. standards. They all cut maintenance costs to a new low.

For your own sake and convenience, get a copy of Chapman Catalog 20 now.

THE CHAPMAN VALVE MANUFACTURING CO.

INDIAN ORCHARD, MASSACHUSETTS

Allis-Chalmers Pumps Meet Power Plant Requirements



New Pumps Give Milwaukee County Institutions

. . . Dependable Power Service

THESE modern multi-stage high pressure pumps assure continuous, economical steam for the Allis-Chalmers 3000-kw steam turbine units at the Milwaukee County Institutions.

As new members of the Allis-Chalmers complete line of pumps, these units are designed to meet medium-high pressure, continuous service requirements of boiler feed duty in lower volume ratings.

Horizontally split casing with suction and discharge in lower half provide for simplified maintenance—without disturbing piping. Both radial and axial balance maintains close clearances and fits, gives low thrust bearing loads. Bearings are double-row ball bearings or alternate sleeve bearing with Kingsbury thrust. Sleeve and Kingsbury combinations have ring oiling as well as pressure lubrication.

You get **MORE** than a Pump . . . When You Specify Allis-Chalmers

You can take advantage of Allis-Chalmers wide experience in supplying pumps to all industries. You are assured of modern design, heavy duty construction and correct application aid — all adding up to years of dependable service.

Allis-Chalmers is the only company that can offer you "One-Source" responsibility, with a complete unit — pump, motor and control — all built to work together. For "MORE" information about Allis-Chalmers pumps, call your local A-C office, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

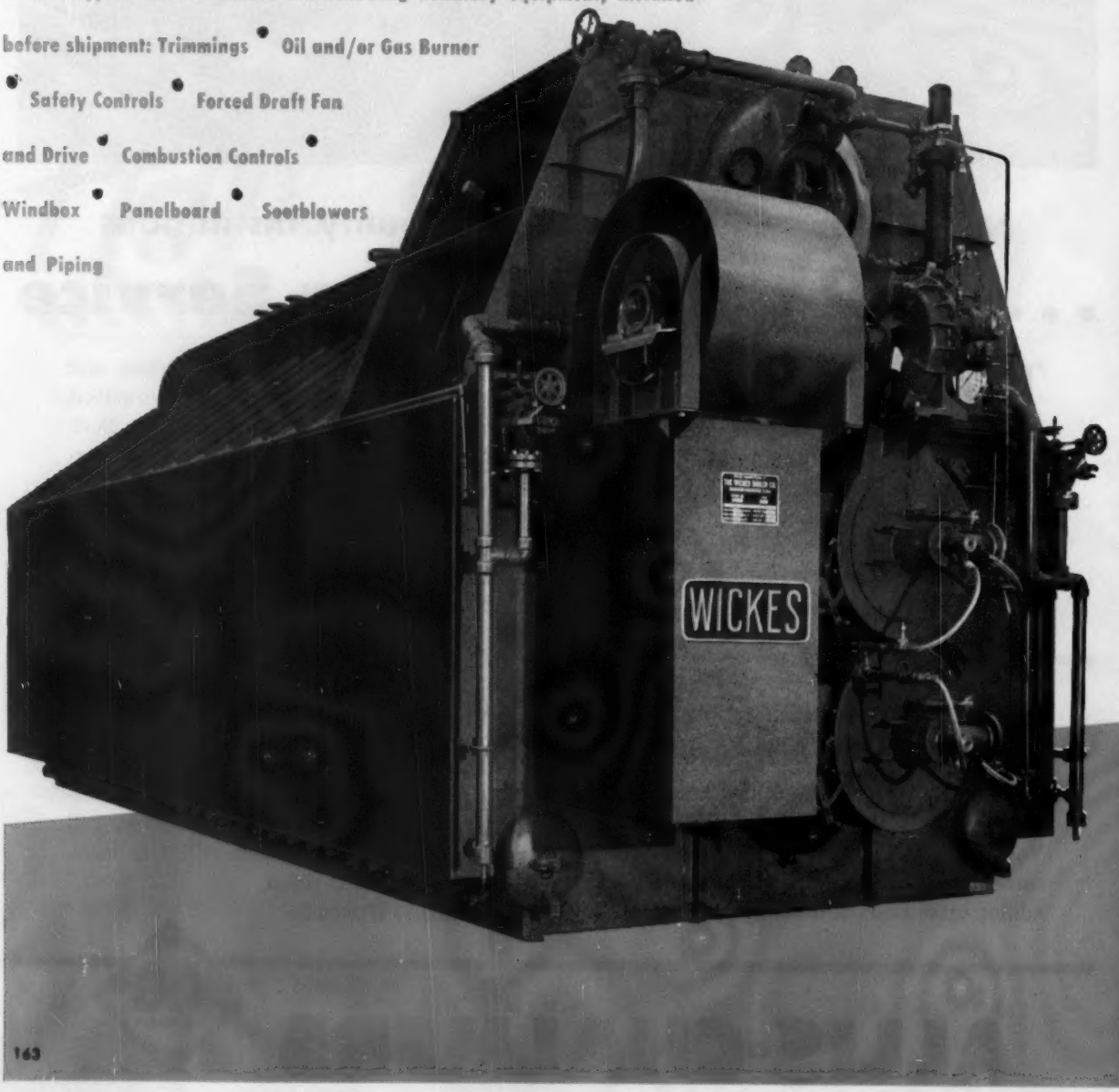
ALLIS-CHALMERS

A-C ALLIS-CHALMERS

A-5098

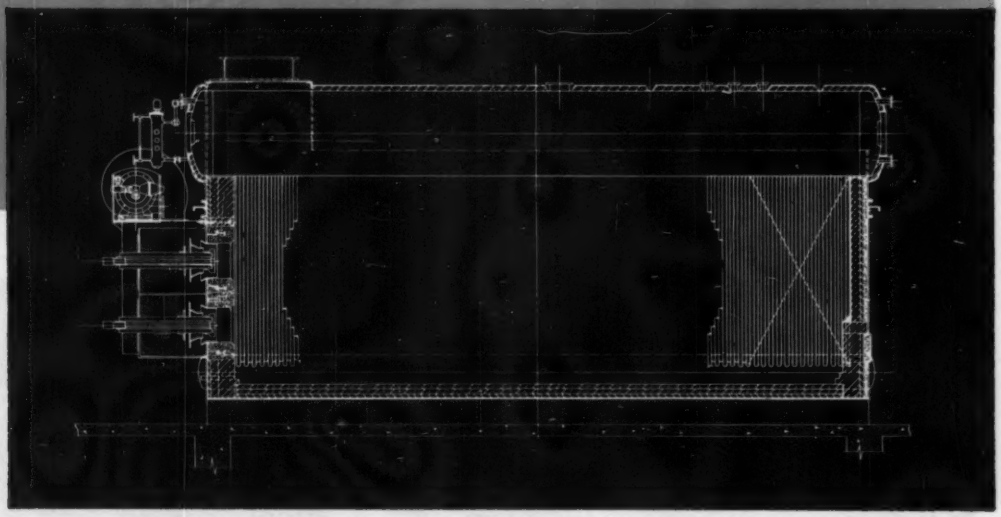
NOW! 60,000 LBS. PER TYPE-A WATER TUBE by WICKES

Wickes Type-A Boilers include the following auxiliary equipment, installed before shipment: Trimmings • Oil and/or Gas Burner • Safety Controls • Forced Draft Fan and Drive • Combustion Controls • Windbox • Panelboard • Sootblowers and Piping



163

HOUR WITH A SHOP-ASSEMBLED STEAM GENERATOR



With capacities for sustained steam production up to 60,000 lbs. per hour the Wickes Type-A Boilers give you "packaged power" ready for immediate installation. They are custom engineered to your requirements and shop-assembled to reduce interruption of operations in your plant to a minimum. Wickes Type-A packaged boilers conserve head-room and floor space and are very simple in design . . . the large furnace is located between two banks of boiler tubes so that each furnace wall is a separate steam generator as well as an integral part of the boiler unit. The steam generator is enclosed in a high quality refractory and insulation setting and protected by a pressure-tight steel casing . . . thus, the pressurized furnace can be operated without a high stack or induced draft fan when burning oil or gas. This casing is also completely weatherproof for outdoor installation.

THE WICKES BOILER CO.

WICKES type A ES

Write for our Catalog 56-1 for detailed information on Wickes Type-A Boilers and we will also include our Bulletin 55-1 covering the complete line of Wickes Products and Facilities.

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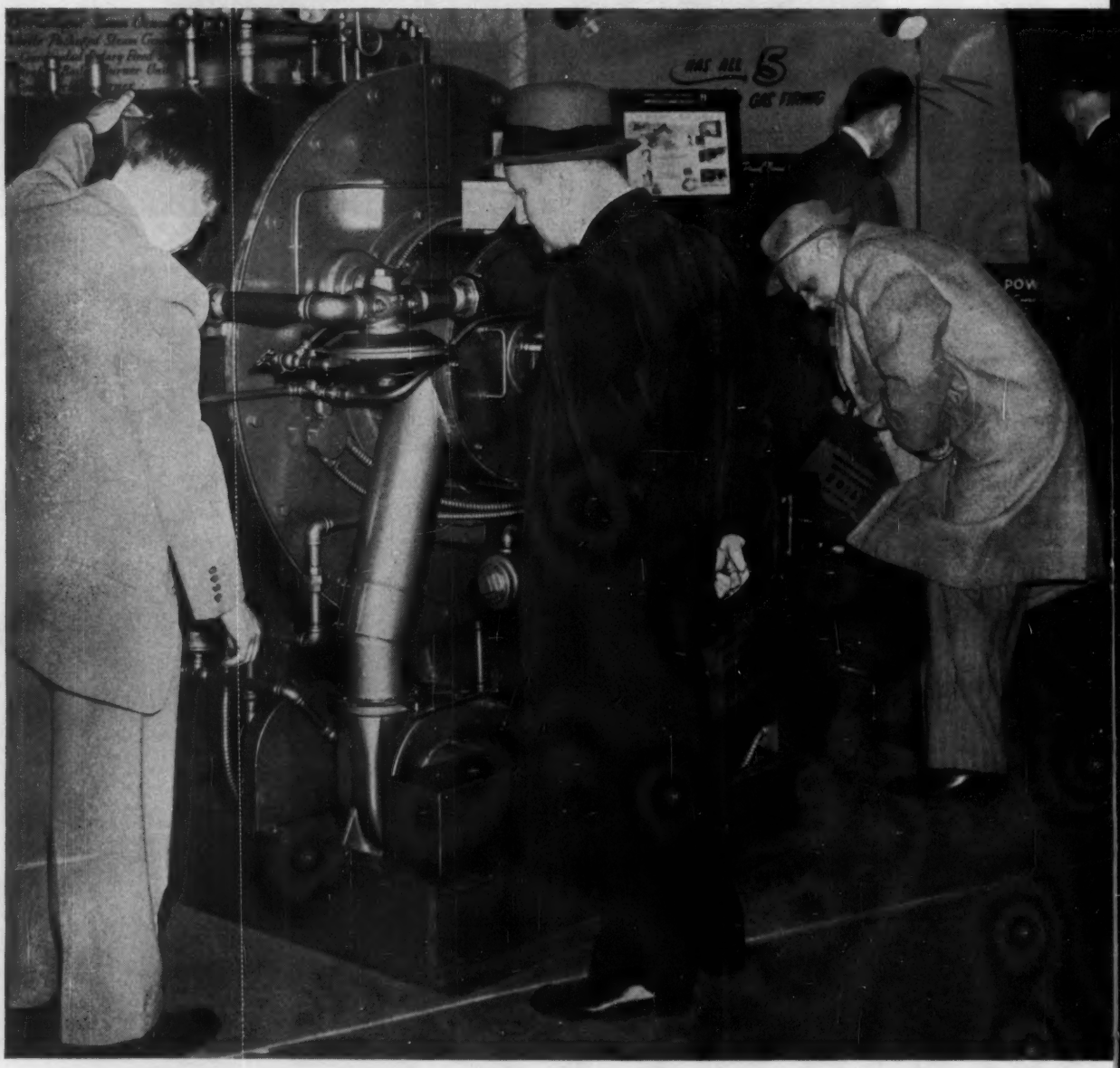

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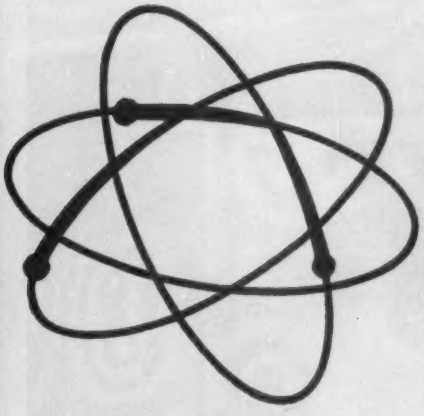

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COMPANY'S BUSINESS,
SERVICE OR PRODUCT_____

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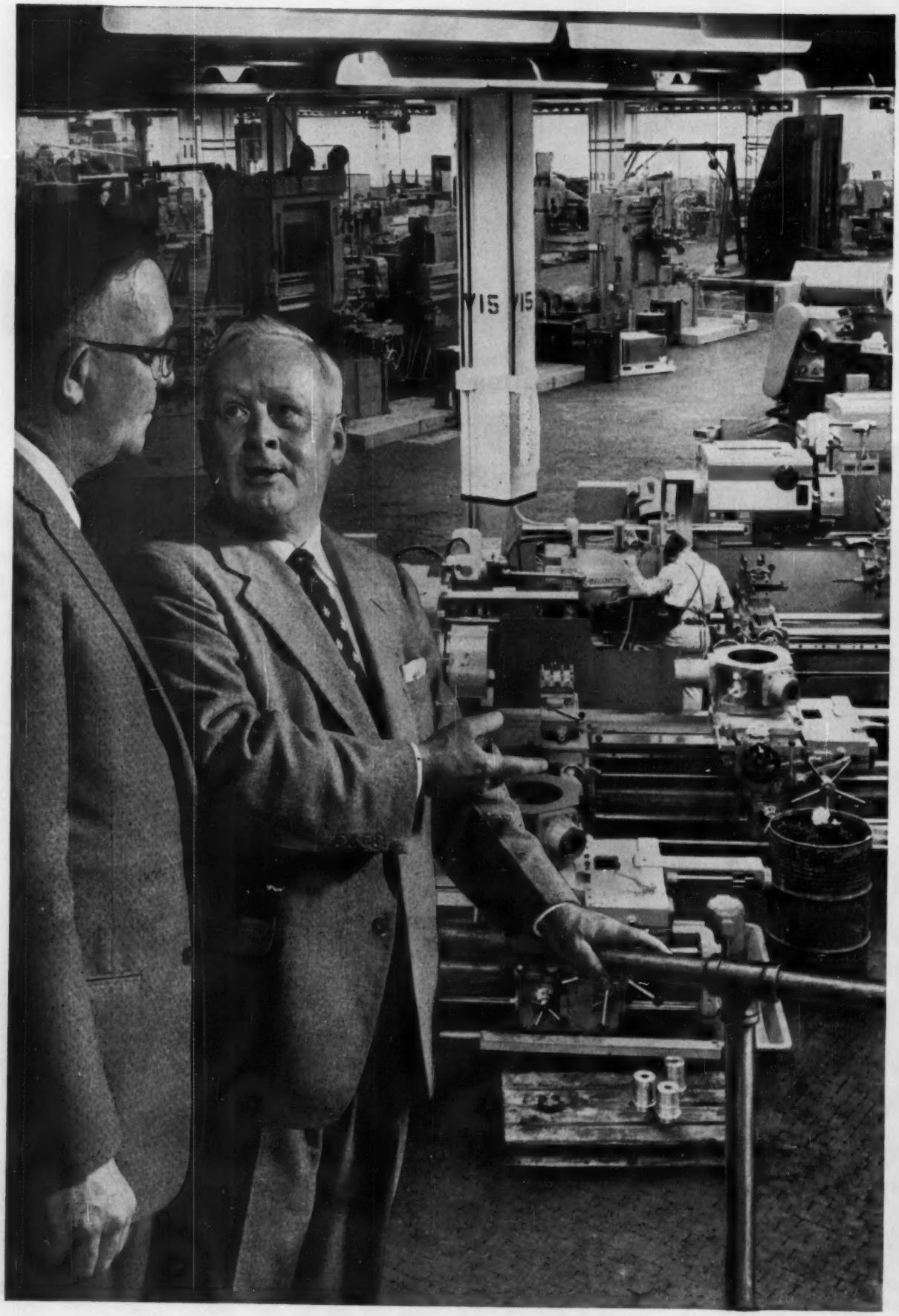


"My boss was stunned when I said . . .

'This plant looks modern... but electrically it's obsolete!' "

"About two years ago the plant manager and I were touring the shop areas. We were half way through when I turned and said, 'This plant looks modern . . . but electrically it's obsolete!'

"As plant electrical services engineer, I got his permission to make a study of our plant power distribution system.

"Even I got a big surprise. We found that the power supply wasn't as safe, dependable or flexible as we required . . . and maintenance costs were getting out of hand. A lot of our electric equipment was antiquated and took up valuable production space.

"We had spent so much time improving manufacturing processes and methods that we had neglected electrical needs. Electrically, we were obsolete . . . and not prepared for the big swing to automation.

"Our plant power distribution system has been modernized since then. We've installed more automatic equipment and work-handling devices, and we are ready to apply more advanced types of automation. Our new branch plant is being provided with electrical adequacy, too.

"You can probably do the same thing we did to get greater efficiency."

J-96101-1

Is your plant suffering from electrical growing pains?

Surveys show that many of the nation's plants are inadequate electrically. A recent study of 42 plants in a given area revealed 88% had electrical problems that interfered with production.

These Problems Can't Wait

	Percent of Plants Inadequate — Electrically*
Inadequate transformer capacity and flexibility	42%
Questionable breaker interrupting capacity	63%
Lack of power centers	62%
Poor power factor	25%
No motor control centers	42%
No plug-in bus duct	32%
Low primary distribution voltage (below 4160 volts)	49%
Low secondary voltage (below 480 volts)	25%
Lack of network distribution systems	90%
Lack of automatic switching to maintain continuity	69%
Absence of 277-volt lighting	94%

*Based on report of survey in 156 top U.S. plants conducted by *Factory* magazine.

WATCH WESTINGHOUSE!

COVER THE PRESIDENTIAL CAMPAIGN ON CBS TV AND RADIO!

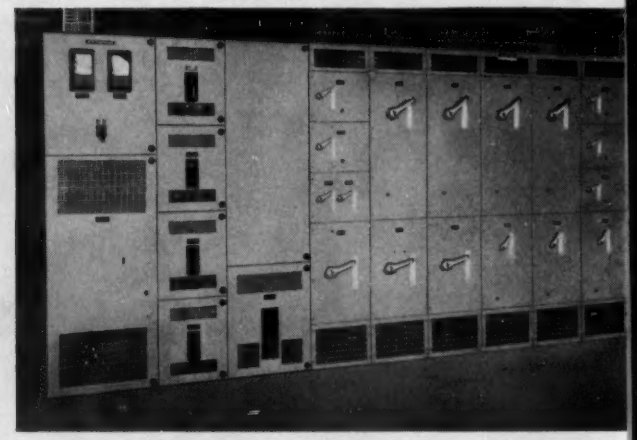
"I called in Westinghouse . . .

Electrical obsolescence disappeared"

Westinghouse switchgear is available in 10 basic units with a selection of standard instrument panels . . . future additions or replacements can be made easily and quickly any time.

"In the process of updating our plant power distribution system, we called upon Westinghouse for expert help. They worked with our staff and consulting engineers to give our plant electrical adequacy.

Westinghouse dry-type transformers save space, mount conveniently in out-of-the-way places. Well suited for wet, dirty or hot locations. Placement close to work load saves long, costly secondary runs.



Expansion with Westinghouse control centers frequently saves as much as 40% on installation costs over decentralized methods of mounting motor control. Inspection and service are simplified.

Switchgear gave us safer, more dependable operation

"We selected Westinghouse low-voltage, metal-enclosed switchgear which gave us high interrupting capacity, assuring safety and operating continuity. It reduced our maintenance, brought economic advantages and freedom to expand our facilities.

"In our new installation, unitized Westinghouse switchgear reduced our special design and engineering expense, and provided custom-built preciseness for our application requirements.

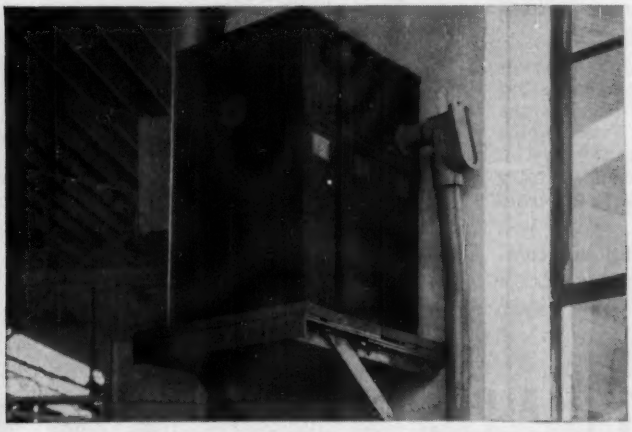
Capacitors paid for themselves in 18 months

"With Westinghouse guidance, we applied capacitors carefully at the substation bus, on secondary bus duct, and right at the motor loads. Savings on our power bill in the first year amounted to 75% of capacitor installed cost. Capacitors paid for themselves in 18 months, and the savings are still going on.

"The capacitors reduced the burden on our feeders and released electrical capacity for other needs. We got better voltage regulation at our motor and lighting loads.

Transformer provided convenient power . . . economically

"We wanted to get power close to the load . . . placing Westinghouse transformers strategically throughout our plant did the job conveniently, economically. For high-impulse levels we used oil- and askarel-filled units, while dry types were used when light weight and ease of installation were vital. I learned that a combination of Hipersil® cores and high-temperature insulation in Westinghouse transformers reduces size and weight one third.



Westinghouse capacitors are low in initial cost, require no maintenance, save additional investment in transformer capacity. Solder-sealed porcelain bushings protect against leaks or contamination of dielectric.

Packaged control simplified system design

"Westinghouse furnished control centers for our permanent machine arrangements. This gave us simplicity in planning and installation, a high degree of safety and flexibility, centralized operation and maintenance.

"Some of our machines were subject to frequent moving. Here we used Westinghouse plug-in bus duct with individual controls at each machine. In both cases, we found that Westinghouse packaged control equipment simplified system design, reduced some costs up to 40%.

"Why not call Westinghouse . . . like I did?"

"I'm sure you'll find Westinghouse a real lifesaver in helping out with your plant power distribution systems, too. Their engineering team will gladly work with your staff and your consulting engineers. I got our plant on the road to electrical adequacy by getting in touch with my local Westinghouse representative."

For more information, call your local Westinghouse sales office or send coupon. Westinghouse Electric Corporation, 3 Gateway Center, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-96101-2

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☐ I would like a showing of the 20-minute film, *Selecting the Right Industrial Distribution System.*

I'm interested in more information about:

☐ Switchgear ☐ Capacitors

☐ Transformers ☐ Controls

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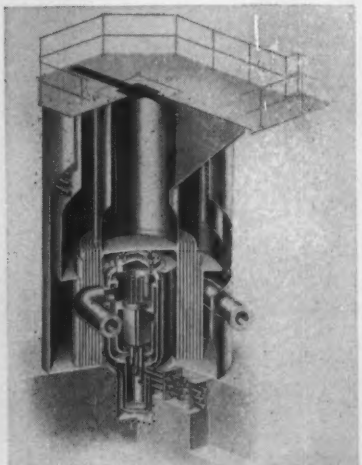
Army Package Power Reactor (APPR) was designed and built by ALCO, *scheduled for completion in early 1957. Reactor will be operated at a heat rate of 10,000 Btu per second (10,000 kw). In construction at Fort Belvoir, Va., vapor container is at left, turbine room at right.*

YOU CAN GET ATOMIC POWER NOW



Reactor, reactor vessel and primary shielding of ALCO *APPR. Control rods and drive are shown top and bottom. Shielding consists of concentric steel cylinders with layer of water between each.*

ALCO's pressurized-water reactor plant is completely designed and engineered; scheduled for operation in early 1957. Similar plants can be purchased to generate commercial power.

Early next year, ALCO's atomic power plant will be in operation generating reliable power. ALCO is building the plant under the first fixed-price reactor contract awarded by the Atomic Energy Commission. Similar plants are available now to generate commercial power.

Design and engineering are complete. As a result, the cost of ALCO's atomic power plants, to about 12,000 kw, is lower than experimental reactors. ALCO's new nuclear criticality facility will further lower costs in reactor testing. Delivery time? Much faster than you'd expect.

Direct utilization of ALCO's atomic plants is economically justifiable in many locations where conventional fuel costs are high, transmission expensive or the location itself inaccessible. In such areas, an ALCO atomic power plant can mean a saving.

For full information relative to your specific project, you may contact your nearest ALCO sales office or write P. O. Box 1065, Schenectady 1, New York.

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NEW YORK

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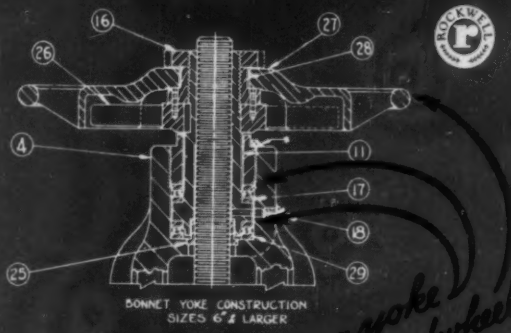
C.F.R.
Edward tests both seats simultaneously for tightness—no leakage into bonnet with these gate valves. Check these features. H.C.K.

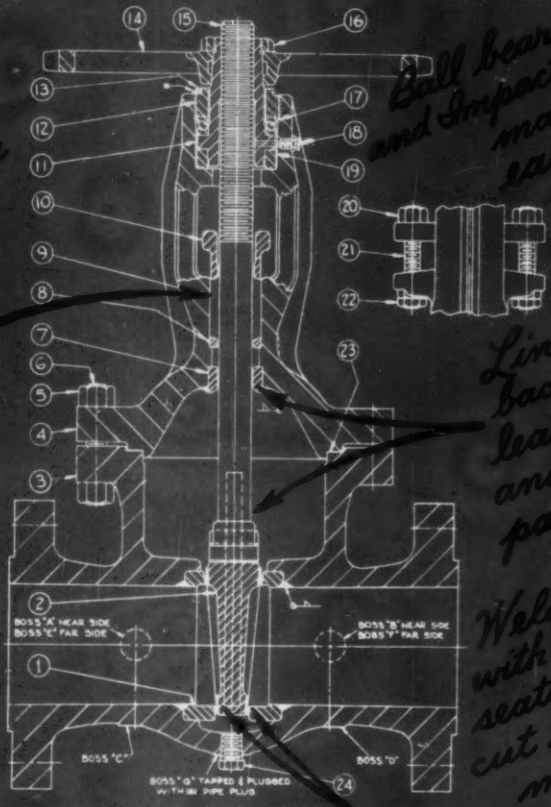


BONNET YOKE CONSTRUCTION
SIZES 6" & LARGER

ROCKWELL BUILT
Edward Valves

Deep packing chamber and preformed EVALPAK packing stop stem leakage and pitting—lower maintenance

Welded-in wedge guides are accurately aligned with seats, wedge, and each other so that wedge travels almost to a closed position before touching seats—reduces wear, extends sealing life of seating surfaces.

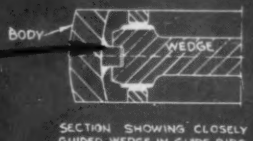


BOTH END FLANGES ARE ALIKE AND HAVE 'J' DIA HOLES ON 'K' DIA B.C. STRADDLE CENTERLINE AND SPOTFACED

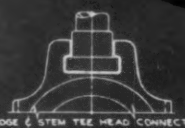
Ball bearing yoke and Impactor handwheel make operation easy in larger Edward gate valves.

Line contact backseat makes leakproof seal and protects packing.

Welded-in seats with Stellited seating surfaces cut repair and maintenance costs.



SECTION SHOWING CLOSELY GUIDED WEDGE IN GUIDE RIBS


WEDGE & STEM TEE HEAD CONNECTION

Edward makes a premium gate valve — a good investment for lower operating expenses. Let's specify them.

LIST OF MATERIAL
QUANTITIES ARE FOR 1 GATE VALVE

PIECE No.	NAME OF PIECE	No. REQ'D	MATERIAL	SPECIFICATIONS	EDW. M'S No.
1	SEAT	2	SEAMLESS STEEL RING	STELLITE FACED	117
2	WEDGE	1	STEEL	STELLITE FACED 5" & LARGER	
3	BODY	1	CAST STEEL GRADE WCB	A.S.T.M. A216-C 0.30% MAX	102
			CAST STEEL GRADE WC1	A.S.T.M. A217-C 0.25% MAX	209
4	BONNET	1	CAST STEEL GRADE WCB	A.S.T.M. A216-C 0.30% MAX	102
			CAST STEEL GRADE WC1	A.S.T.M. A217-C 0.25% MAX	209
5	BONNET STUD NUTS		STEEL	A.S.T.M. A194	
6	BONNET STUDS		ALLOY STEEL	A.S.T.M. A193	
7	BONNET BUSHING	1	EVALLOY	A.S.T.M. A182, F6	212
8	JUNK RING	1	STEEL	EVALIZED	123
9	PACKING		EVALPAK	O RINGS MINIMUM	
10	GLAND	1	STEEL	A.S.T.M. A108	111
11	YOKE BUSHING	1	BRONZE	A.S.T.M. B148 GRADE 9B	432
12	YOKE BUSHING LOCKNUT	1	EVALLOY	A.S.T.M. A182, F6	212
13	YOKE BUSHING LOCKNUT SET SCREW	1	STEEL		
14	HANDWHEEL	1	MALLEABLE IRON	A.S.T.M. A126 CLASS B	322
15	STEM	1	EVALLOY	A.S.T.M. A182, F6	212
16	HANDWHEEL LOCKNUT	1	STEEL	A.S.T.M. A108	121
17	UPPER BALL BEARING	1	BALL THRUST	S.A.E. STANDARD	
18	ALEMITE FITTING	1	BUTTONHEAD INDUSTRIAL TYPE		
19	LOWER BEARING PLATE	1	STEEL	EVALIZED	
20	GLAND BOLT NUT	2	STEEL CLASS 10 OR 2	A.S.T.M. A194	
21	GLAND BOLT	2	ALLOY STEEL GRADE B7	A.S.T.M. A193	
22	JAM NUT	4	STEEL CLASS 10 OR 2	A.S.T.M. A194	
23	GASKET	1	IRONKOTE (90 DUR MAX)	ARMCO IRON	
24	PIPE PLUG	1	STEEL		
25	SEALING WASHER	1	STEEL	EVALIZED	123
26	CROSS ARM	1	CAST STEEL	A.S.T.M. A216	102
27	IMPACTOR HANDWHEEL	1	CAST IRON	A.S.T.M. A126 CLASS A	
28	HANDWHEEL BUSHING	1	BRASS	COMMERCIAL QUALITY	
29	LOWER BALL BEARING	1	BALL THRUST	S.A.E. STANDARD	

Edward builds Globe and Angle Stop, Non-Return, Check, Stop-Check, Gate, Blow-Off, Mudline, Relief, Hydraulic, Instrument, Gage, and Special Valves and Strainers.

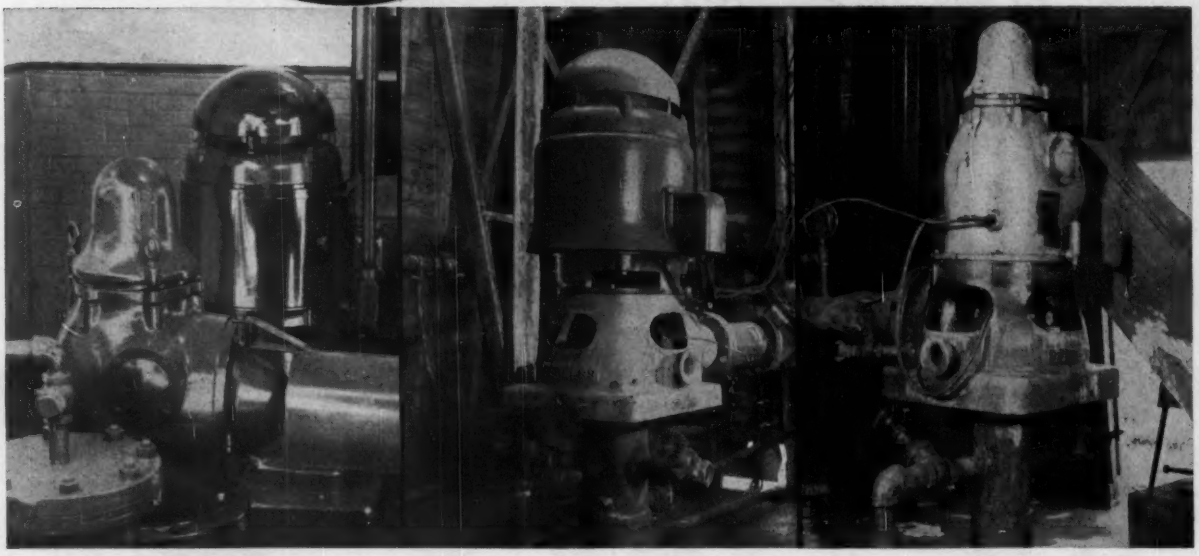
EDWARD VALVES, INC.
SUBSIDIARY OF ROCKWELL MANUFACTURING CO.
EAST CHICAGO, INDIANA

CAST STEEL GATE VALVE
GENERAL ASSEMBLY

DRAWN [illegible]
CHK'D. O. Peters
APP'D Tinsdale
DATE [illegible]

DRAWING NO. AE-3207-1

PEERLESS PUMPS ON THE LINE



FOR *Fire*... FOR *Water*... FOR *Brine*...

MORTON SALT "WHEN IT RAINS—IT POURS"

HERE IS INSTALLATION VERSATILITY AVAILABLE ONLY WITH VERTICAL PUMPS

MORTON SALT COMPANY, RITTMAN OHIO PLANT, USES PEERLESS VERTICAL PUMPS FOR ALL 3 IMPORTANT PLANT DUTIES

They supply all the water for the plant—
They provide approved fire protection—
They pump the salt wells...

Here's what U. J. Grant, Morton Salt Rittman, Ohio Works Engineer, says about Peerless vertical pump operation costs. On the particularly *tough* service of pumping brine, he states, "we recently repaired an 8" deep well Peerless pumping unit installed in our No. 19 salt well. This unit was installed in 1949. The original pump bowl assembly was apparently in good condition and was put back in the well. Considering this unit is rated at 400 gpm with more than 5 years operation we are well within my estimate that upkeep costs are one cent or less per 1000 gallons of brine pumped. This cost applies to the small Peerless pumps we also use!"

Verified low Peerless maintenance costs on tough service like pumping salt wells points up how inexpensive it is to put the *economical* versatility of Peerless vertical pumps to work for you. Use the coupon for information about the VERTICAL VERSATILITY of Peerless industrial service pumps.

MORTON SALT KNOWS WHAT VERTICAL VERSATILITY MEANS!

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION
301 WEST AVENUE 26, LOS ANGELES 31, CALIFORNIA

PEERLESS PUMPS — fmc FOOD MACHINERY AND CHEMICAL CORPORATION

Factories: Los Angeles 31, California and Indianapolis 8, Indiana

Offices: New York; Atlanta; Chicago; St. Louis; Phoenix; San Francisco; Fresno; Los Angeles; Plainview and Lubbock, Texas; Albuquerque.

Distributors in Principal Cities.
Consult your Telephone Directory.

Please send vertical Pump Bulletins describing ☐ *FIRE PROTECTION* (B-1500) ☐ *INDUSTRIAL SERVICE* (B-505) ☐ *WATER SUPPLY* (B-141)

NAME_____ COMPANY_____

ADDRESS_____ CITY_____ STATE_____

POW

R.T.M.
This steel valve with these standard features has an original cost in the bronze valve bracket. S.P.D.

ROCKWELL BUILT
Edward Valves

Centerless ground EValloy stem increases packing life; cuts maintenance.

"V" design reduces pressure drop, turbulance, wear.

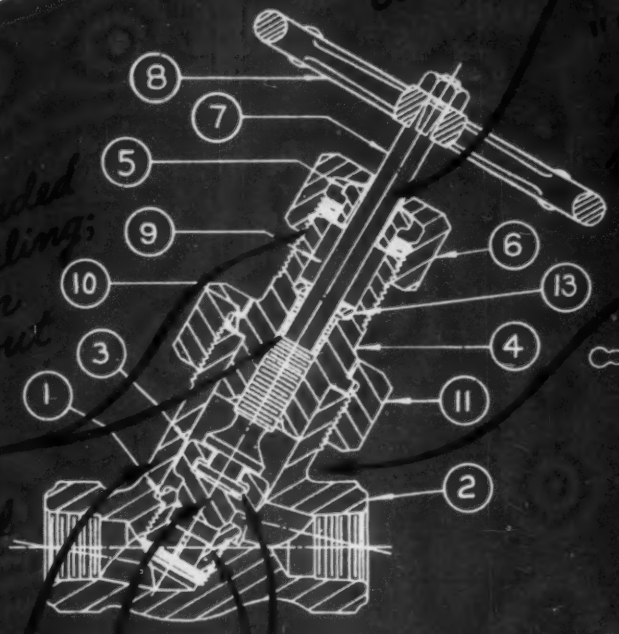
EValized threaded surface stop fouling; make operation easy throughout valve service life.

All forged steel construction reduces bulk, eliminates porosity.

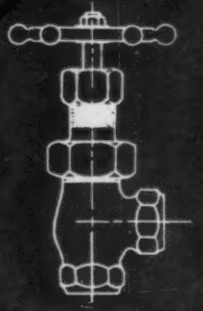
Solid EValloy stainless stem, seat and disk add "years" of service to this steel valve.

Vacuum test on mated seat and disk insure drop-tight closures.

We can save money and cut replacement cost with Edward Fig 2698 globe and 2699 angle valves. Let's order them.



GLOBE VALVES-SCREWED ENDS FIG. 2698



ANGLE VALVES
SCREWED ENDS—FIG. 2699
SOCKET WELDING ENDS—FIG. 2699Y
EXCEPT FOR BODIES GLOBE & ANGLE VALVES ARE ALIKE

LIST OF MATERIAL
QUANTITIES ARE FOR 1 GLOBE OR ANGLE VALVE

PIECE Nº	NAME OF PIECE	Nº REQ'D	MATERIAL	SPECIFICATIONS	EMERSON'S Nº
1	SEAT	1	EVALLOY	A.S.T.M. A182, F6	212
2	BODY	1	FORGED STEEL	A.S.T.M. A105 CLASS II MAX C 0.30%	111
3	DISK	1	EVALLOY	A.S.T.M. A182, F6	212
4	BONNET	1	FORGED STEEL-EVALIZED	A.S.T.M. A105 CLASS II	111
5	GLAND	1	STEEL		123
6	PACKING NUT	1	STEEL-EVALIZED		
7	STEM	1	EVALLOY	A.S.T.M. A182, F6	212
8	HANDWHEEL	1	MALLEABLE IRON	A.S.T.M. A47 GRADE 32510	322
9	PACKING		EVALPAK		501
10	GASKET	1	IRONKOTE (90 BHN MIN)	ARMCO IRON	505
11	UNION RING	1	STEEL	A.S.T.M. A105 CLASS II	111
13	JUNK RING	1	S.A.E. STEEL	EVALIZED	
14	Nº 1 BABBIT CHAIN	1			
15	PADLOCK	1	BRASS		

EDWARD VALVES, INC.
SUBSIDIARY OF ROCKWELL MANUFACTURING CO.
EAST CHICAGO, INDIANA

FORGED STEEL 600 LB
GLOBE AND ANGLE VALVES
GENERAL ASSEMBLY

DRAWN: [illegible]
CHK'D: [illegible]
APP'D [illegible] DATE: 12-15-53

BE-3034-3

Edward builds Globe and Angle Stop, Non-Return, Check, Stop-Check, Gate, Blow-Off, Mudline, Relief, Hydraulic, Instrument, Gage, and Special Valves and Strainers.

First
Research-Cottrell
"Double-Deck"
Fly Ash Precipitator

Space was a big problem in this installation at the Burlington Generating Station of Public Service Electric and Gas Company of New Jersey. Two integral combination mechanical-electrical precipitators, large enough to handle 600,000 cfm of gas from Boiler No. 7, had to be squeezed into the smallest possible ground area.

If a conventional side-by-side arrangement had been used, these two units would have required about 1,700 square feet. By "stacking" the two combination precipitators, one on top of the other, Research was able to cut this space requirement by 50% — a saving of 850 square feet.

Although this arrangement had never been attempted with Research fly ash precipitators, Research knew from their experience with more than 500 central station Cottrells that it could be done. Guaranteed for 97% collection efficiency, these Burlington Generating Station units were placed in operation in October, 1955.

Perhaps you, too, have a knotty problem that demands a more creative approach — backed up by experience with over 500 fly ash precipitators. Whether you require a straight precipitator or a combination unit, at Research-Cottrell you can be sure of the most economical solution to your problem.

Other Research-Cottrell Precipitators at Public Service Electric and Gas Company of New Jersey

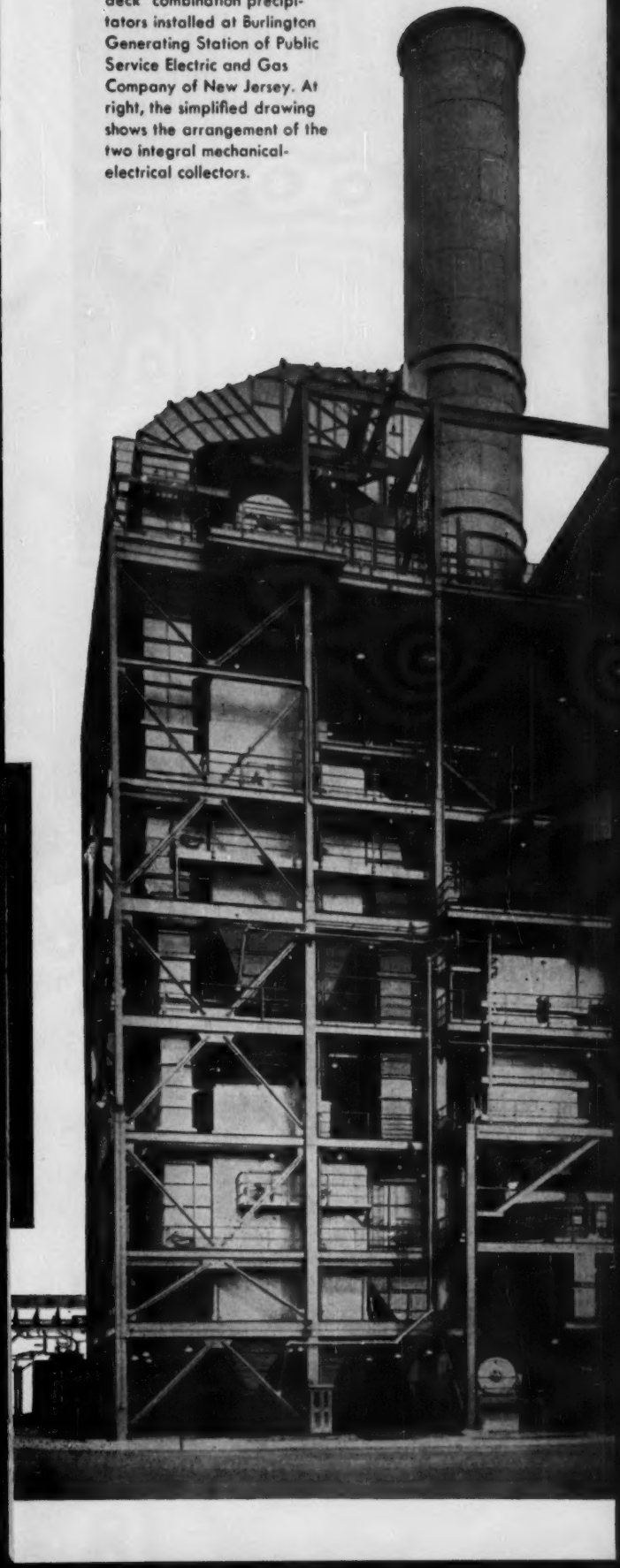
Installation Date	Generating Station	Boiler Number	Number of Pptrs.	C. F. M.
1937	Burlington	11	1	270,000
1938	Essex (Newark)	25 and 26	4	520,000
1940	Burlington	12 and 13	2	448,000
1941	Marion (Jersey City)	51 and 52	2	448,000
1942	Burlington	14 and 15	2	448,000
1946	Kearny	1 (Mercury Blr.)	1	160,000
1947	Essex (Newark)	1	3	380,000
1955	Burlington	7	2*	600,000
		Total	17	3,274,000

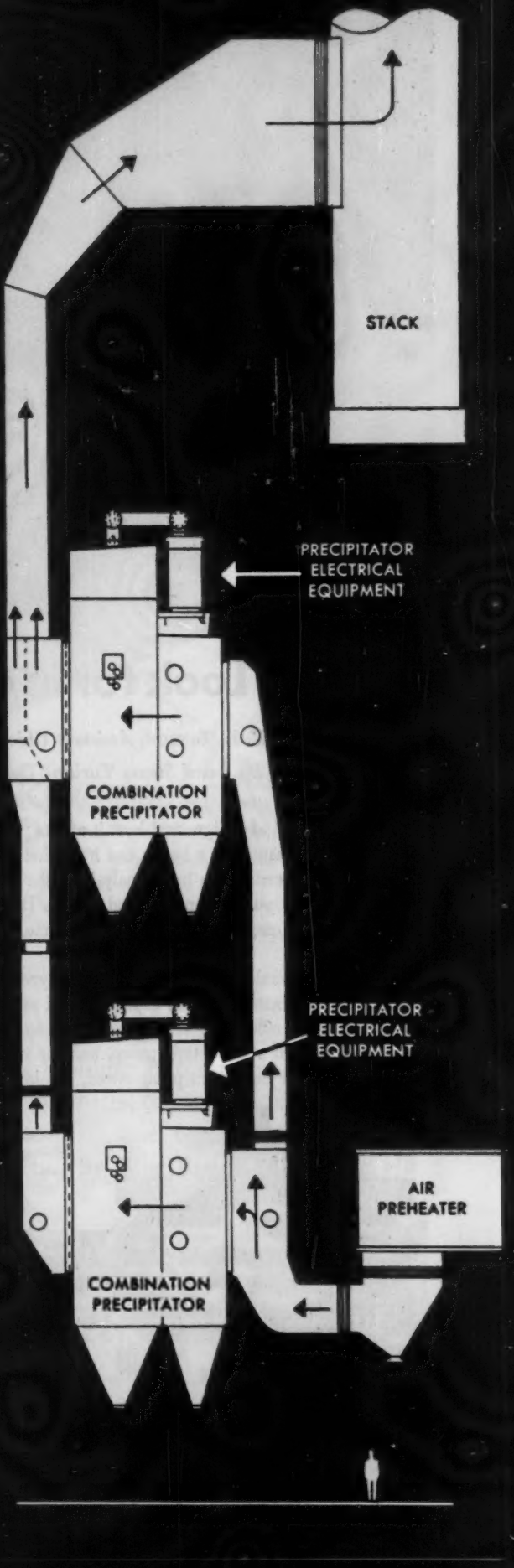
*"Double-Deck" Arrangement

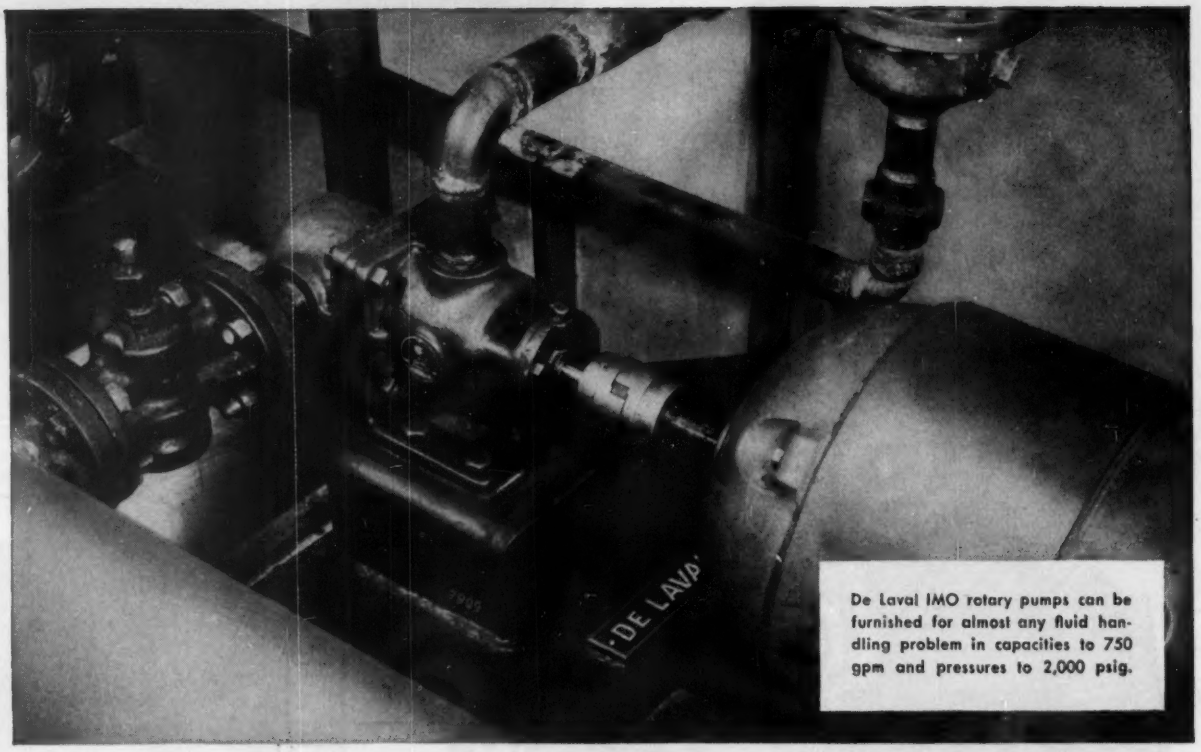
Research-Cottrell, Inc.

Main Office and Plant: Bound Brook, New Jersey • 405 Lexington Ave., New York 17, N. Y.
Grant Building, Pittsburgh 19, Penna., 228 No. La Salle St., Chicago 1, Ill. • 111 Sutter Bldg., San Francisco 4, Cal.

Research-Cottrell's "double-deck" combination precipitators installed at Burlington Generating Station of Public Service Electric and Gas Company of New Jersey. At right, the simplified drawing shows the arrangement of the two integral mechanical-electrical collectors.







De Laval IMO rotary pumps can be furnished for almost any fluid handling problem in capacities to 750 gpm and pressures to 2,000 psig.

What to Look for in a Rotary Screw Type Pump

By W. J. MONCON, *Assistant Chief Engineer*
De Laval Steam Turbine Company

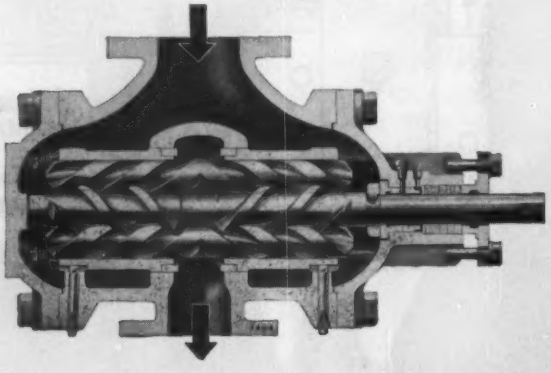
A sound knowledge of design, and how it affects performance, is the best insurance a buyer can have that he will get the pump he needs. This brief analysis of the IMO, a rotary three-screw pump manufactured by the De Laval Steam Turbine Company, will give you some of the necessary facts.

What qualities should you look for in a rotary type pump? It must, of course, meet specified capacities and pressures. But, it must also be efficient, operate quietly, stay on the job.

The axial flow of a screw type pump, and the resulting low inlet losses for any given pump speed, are important benefits that should be considered in making pump selections. The absence of timing gears and other mechanical features of construction also enable the De Laval IMO pump to operate at direct-connected motor and turbine speeds . . . to handle viscous liquids and high suction lifts.

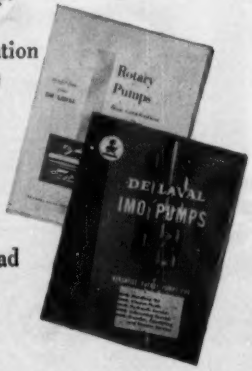
One of the most important features of the IMO pump is the hydraulic turning of the idler or sealing rotors. The central or power rotor is the pumping element; the liquid pumped turns the sealing rotors.

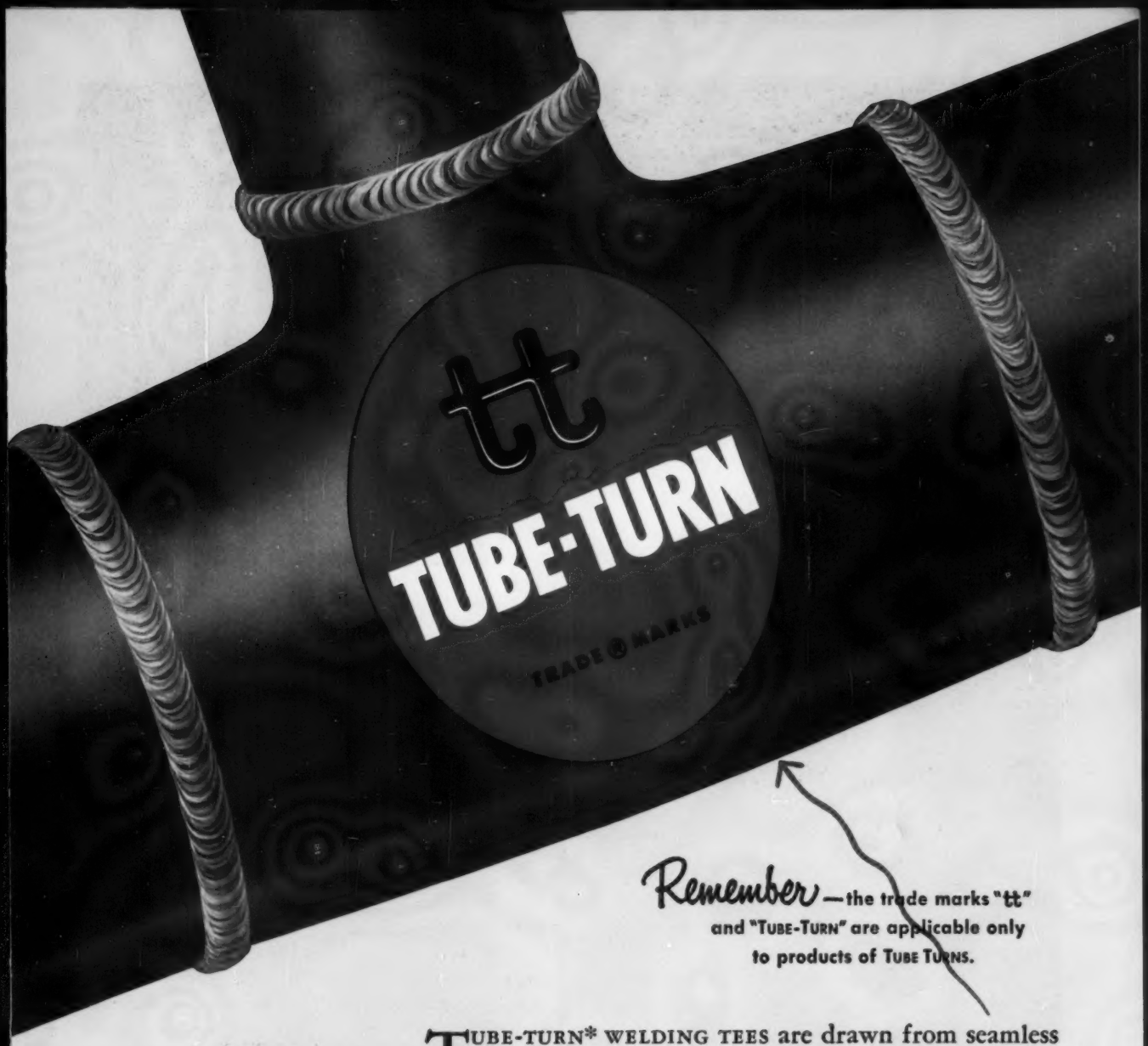
A screw type pump is well suited for applications where pulsation-free flow is desirable. The axial flow of the liquid without trapping and the unique thread form which keeps closures fluid-tight contribute to quiet operation of the IMO pump.



This is a cross-section of the De Laval IMO Series A322A, a positive displacement rotary screw type pump.

Catalog LS gives useful application and specification data on the IMO pump. An article titled, *Rotary Pumps, Basic Considerations in Their Application,* contains a description of rotary pumps in general. For these publications, write on your company letterhead to De Laval Steam Turbine Company, 815 Nottingham Way, Trenton 2, New Jersey. DL-301





Remember—the trade marks "tt" and "TUBE-TURN" are applicable only to products of TUBE TURNS.

You get extra strength with *The Leading Brand*

TUBE-TURN* WELDING TEES are drawn from seamless tubing to a barrel shape. This, and other design features produce high strength—averaging over 25% more than required by applicable standards.

Specify TUBE-TURN Welding Fittings and Flanges for extra values: superior products, the exact fitting or flange you need from our complete line, outstanding engineering service. Call your nearby Tube Turns' Distributor. He is at your service!

The Leading Manufacturer of Welding Fittings and Flanges

TUBE TURNS

LOUISVILLE 1, KENTUCKY

A DIVISION OF NATIONAL CYLINDER GAS COMPANY

DISTRICT OFFICES: New York • Philadelphia • Cleveland • Toledo • Chicago • Denver • Los Angeles
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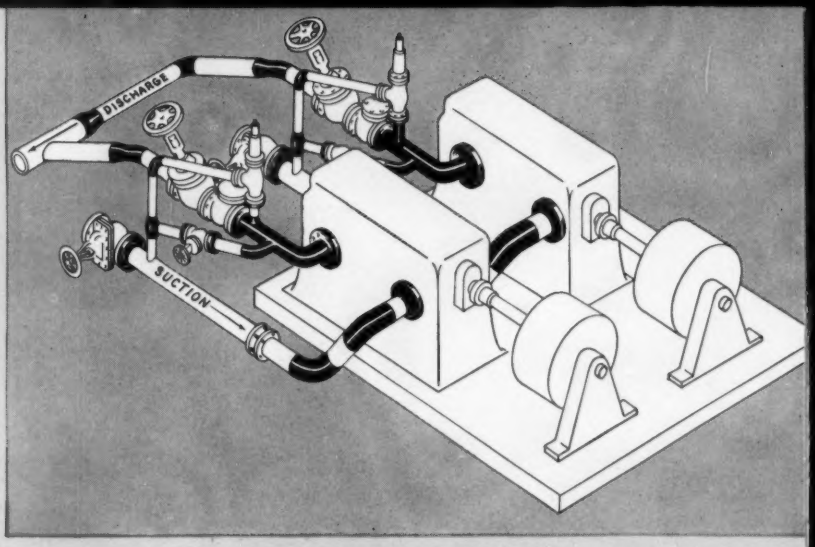
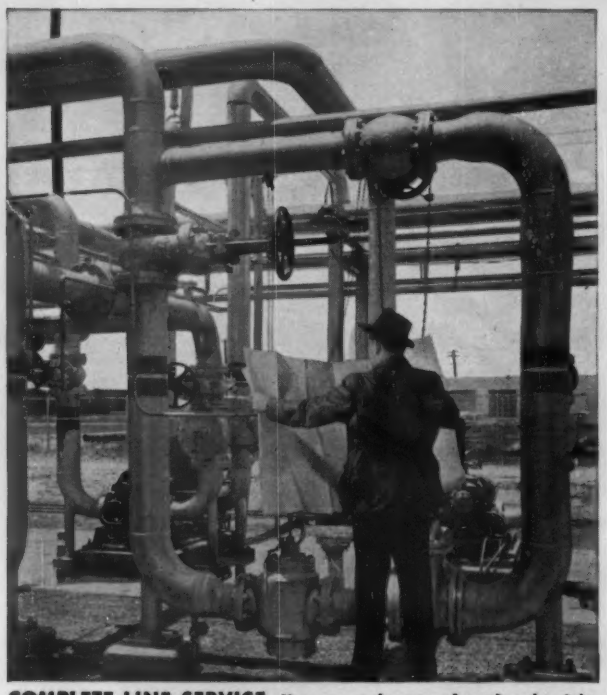
EXTRA VALUES

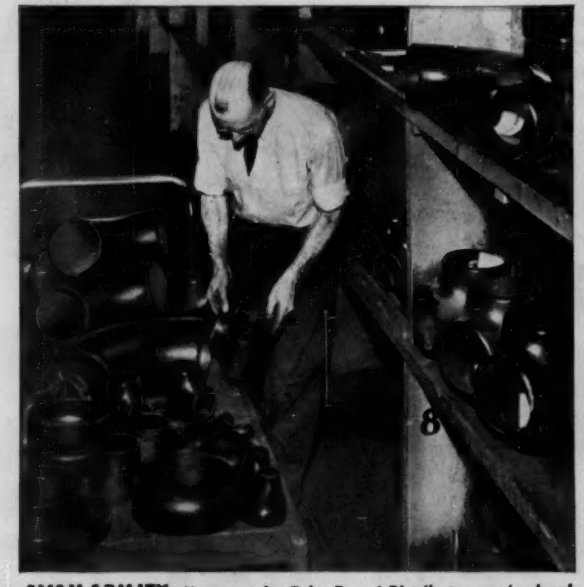
Speed up your piping jobs with TUBE TURNS' SERVICE



ENGINEERING SERVICE—Tube Turns' Engineering Service can help you on your piping projects. For example: Diagram above shows an application where TUBE-TURN* Welding Fittings and Flanges simplified the design and erection of pump piping. They save time, save space, and make the piping permanently leakproof and reliable. Ask your Tube Turns' Distributor to give you the pump piping recommendations of Engineering Service.



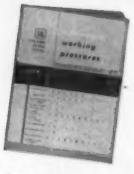
COMPLETE LINE SERVICE—You can make sure of getting the right fitting for each job when you specify "TUBE-TURN". This is the world's most complete line of welding fittings and flanges, including more than 4000 items, in all piping materials, schedules, and sizes.



AVAILABILITY—Your nearby Tube Turns' Distributor carries local stocks for fast delivery. Call him for good service in good connections.

Technical data service

Tube Turns is recognized as a leading source of authoritative information on piping design. For booklet on "Allowable Working Pressures", fill out and send the coupon now!



TUBE TURNS, Dept. C-5
224 East Broadway, Louisville 1, Kentucky

Please send free copy of "Allowable Working Pressures"

Company Name _____

Company Address _____

City _____ *Zone* ____ *State* ____

Your Name _____

Position _____

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Midland, Texas	

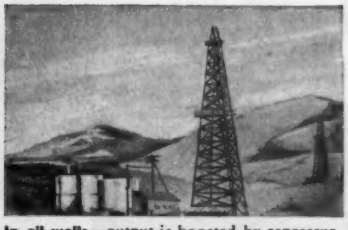
* "tt" and "TUBE-TURN" Reg. U.S. Pat. Off.

TUBE TURNS

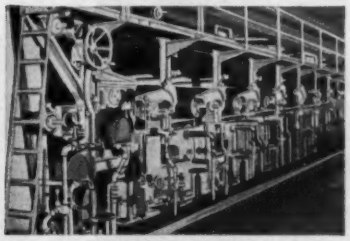
A DIVISION OF NATIONAL CYLINDER GAS COMPANY

LOUISVILLE 1, KENTUCKY

CELITE FILTRATION controls water purity— removes *all* suspended solids



In oil wells—output is boosted by repressurizing wells with water to force out accumulated oil. Celite Filtration purifies water to the extreme degree required—removes the minute suspended impurities which would otherwise clog the microscopic pores of sandstone.



In paper plants—Celite Filtration is used to purify the large quantities of water used in paper formation. Waste water may be filtered for reuse by the same process. Celite filter cakes can withstand many times the pressure of an ordinary filter bed. No pH control is necessary with Celite. *T.M. Reg. U.S. Pat. Off.

CELITE* FILTRATION provides the *right degree* of purity that you require for industrial process water. It removes sediment which may cause costly downtime or damage to expensive plant equipment. And if your application requires greater purity, Celite removes even such fine suspended solids as amoebae and algae, many of which cannot be filtered out by other methods. Moreover, fast, economical rates of flow can be maintained with Celite Filtration

This selectivity in degree of water purity is made possible because Celite comes in nine standard grades . . . each designed to filter out impurities of specific size and type. Carefully processed from the purest deposits of diatomaceous earth, Celite always has utmost uniformity of product. Whenever you reorder, you are assured of the same accurately graded powder.

Celite Filtration offers many other advantages, too. Important space savings are achieved in the installation, longer filtration cycles are obtained, and less backwash water is required for cleaning the filters than with ordinary systems.

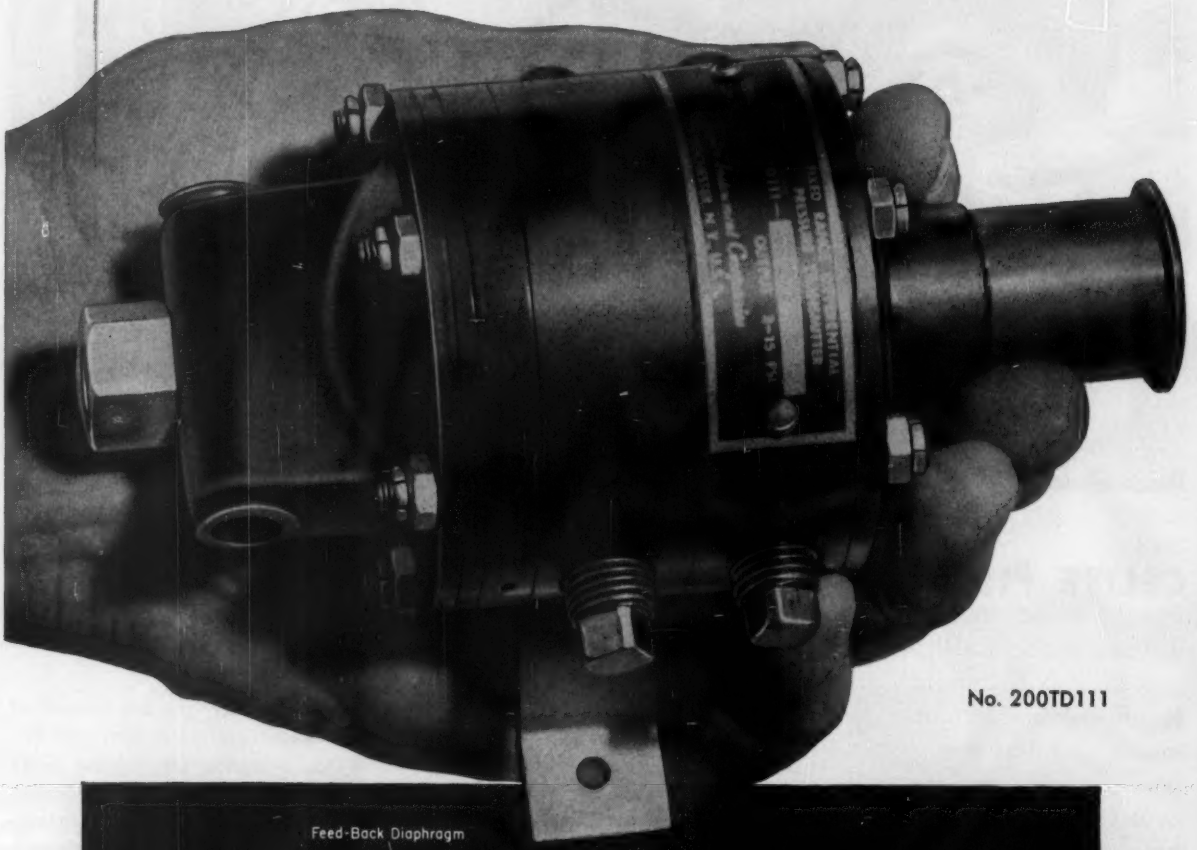
Celite Filtration provides pure process water for boiler make-up, heat exchangers, circulating water for towers . . . and many other industrial uses. It will pay you to investigate the advantages of Celite for your particular application. To have a Celite engineer study your problem and offer recommendations, simply write Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay Street, Toronto 1, Ontario.

JOHNS-MANVILLE JM PRODUCTS

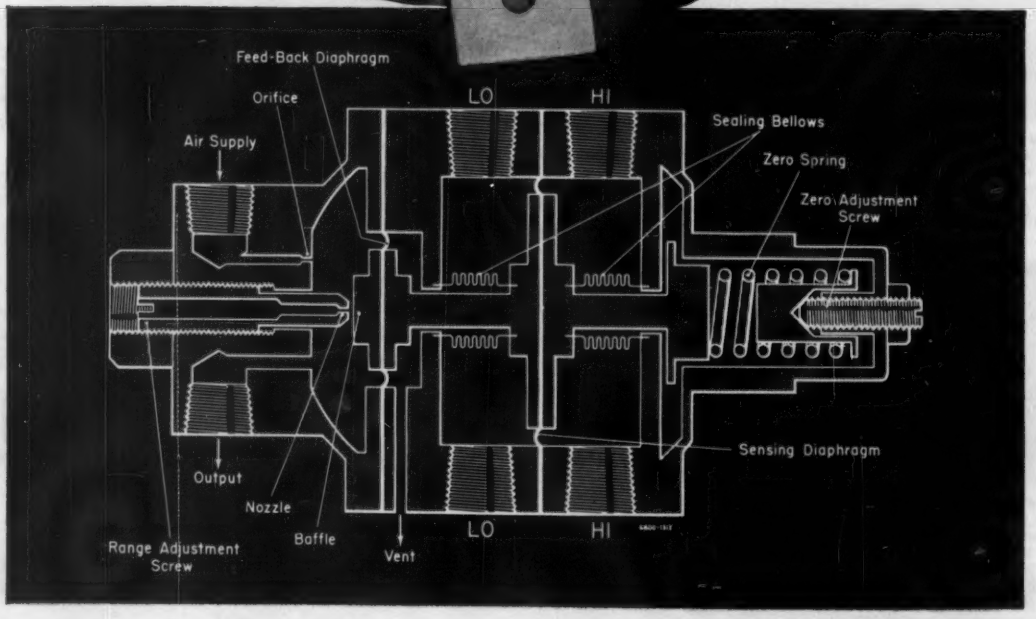
Johns-Manville CELITE FILTER AIDS

Taylor Presents

ACTUAL SIZE 6½" x 3"



No. 200TD111



NEW LOW COST FLOW TRANSMITTER

The new Taylor Fixed Range Differential Pressure Transmitter (200TD111) provides an excellent, economical means of measuring flow, liquid level, or pressure. A 3 to 15 psi signal is transmitted to an indicating, recording or controlling receiver with an accuracy of 1%. Its remarkably low price makes it a practical cost accounting aid for many applications previously considered marginal. Check these features:

Simple to install. Piping is simplified because it can be close coupled to orifice flanges. Can be lead-line or bracket mounted. No seal pots required. Mercuryless, no leveling required. Force-balance construction means negligible displacement. 4½ lb. weight, 6½″ x 3″ size make it easy to handle.

Easy to maintain. External zero and range adjustments. Self draining or venting. Over-range to full working pressure with no permanent damage. Purges, if required, can be installed to keep body swept clean. Minimum number of parts.

Reliable accuracy. Calibration accuracy is better than 1%. Unaffected by piping or mounting stresses. No errors build up during operation because of self draining and venting feature. Pressure effect 2%/150 psi (100″ range). Temperature effect 2%/100°F. (100″ range). Sensitivity exceeds 0.1%.

Rugged and dependable. No stuffing box, levers or pivots. No relay valve. Compact, weatherproof, built for rough service and outdoor mounting.

Adaptable. Ranges 0 to 50, 100, 200 and 300 inches of water—easily and quickly changed by substitution of range ring and diaphragm.

No. 200TD111, Fixed Range Differential Pressure Transmitter. Immediate Delivery from Stock.

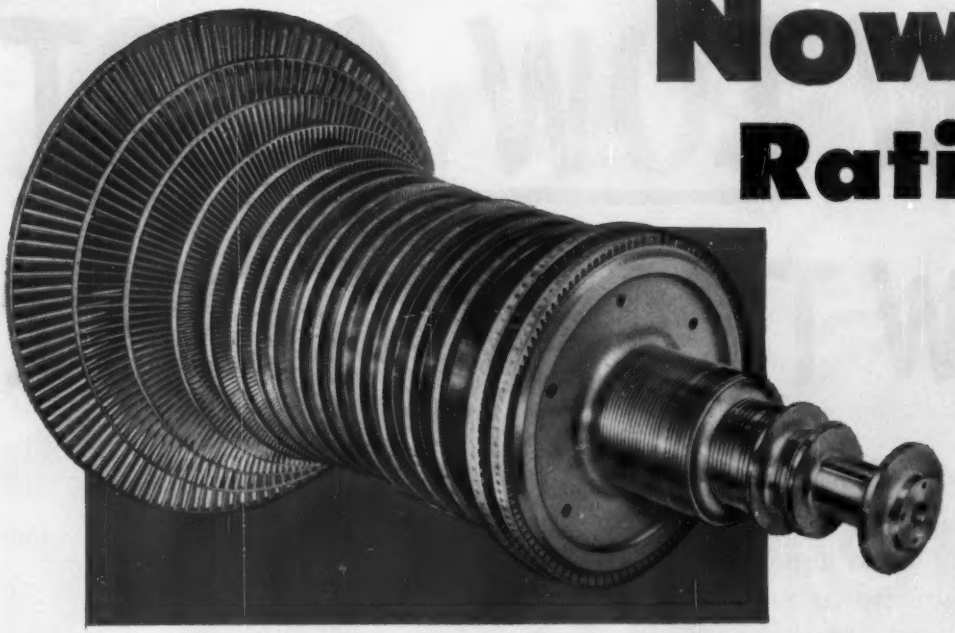
Call your Taylor Field Engineer to discuss possible applications for this remarkable new instrument in your plant. And write for **Bulletin 98274.** Taylor Instrument Companies, Rochester, N.Y., or Toronto, Canada.

DESIGN SPECIFICATIONS

Diaphragm of Neoprene impregnated Nylon.
Body material brass.
Maximum working pressure 150 psi.; temperature 150°F.
Air Supply pressure, 20 psi.
Air consumption, 0.10 standard cu. ft. per minute.
Output pressure range 3 to 15 psi.
Size 6½″ x 3″, Weight 4 lbs. 9 oz.
All connections ¼″ internal NPT.

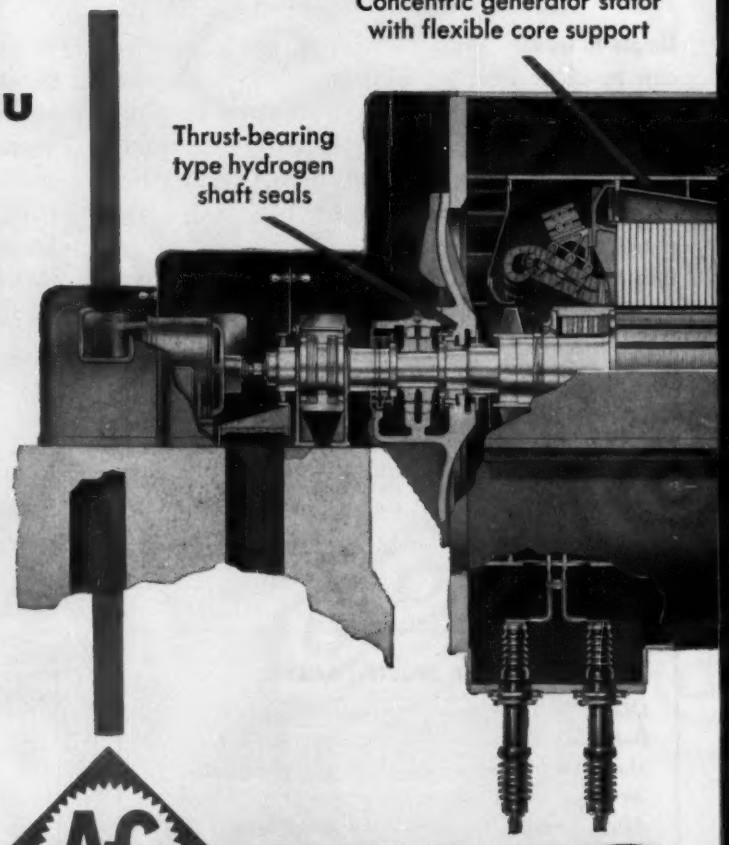
Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY

Now in Ratings



Here is the turbine rotor for one of the 16,500-kw units now being built. For this 850-psig, 900-F AIEE-ASME turbine, rotor shaft and wheels are of integrally forged construction.

Allis-Chalmers Turbines Give You MORE Modern Design Features



CUTAWAY VIEW of 16,500-kw unit shows the development of impulse turbine design for larger ratings.

A-C ALLIS-CHALMERS

ALLIS-

Production up to 16,500 Kw

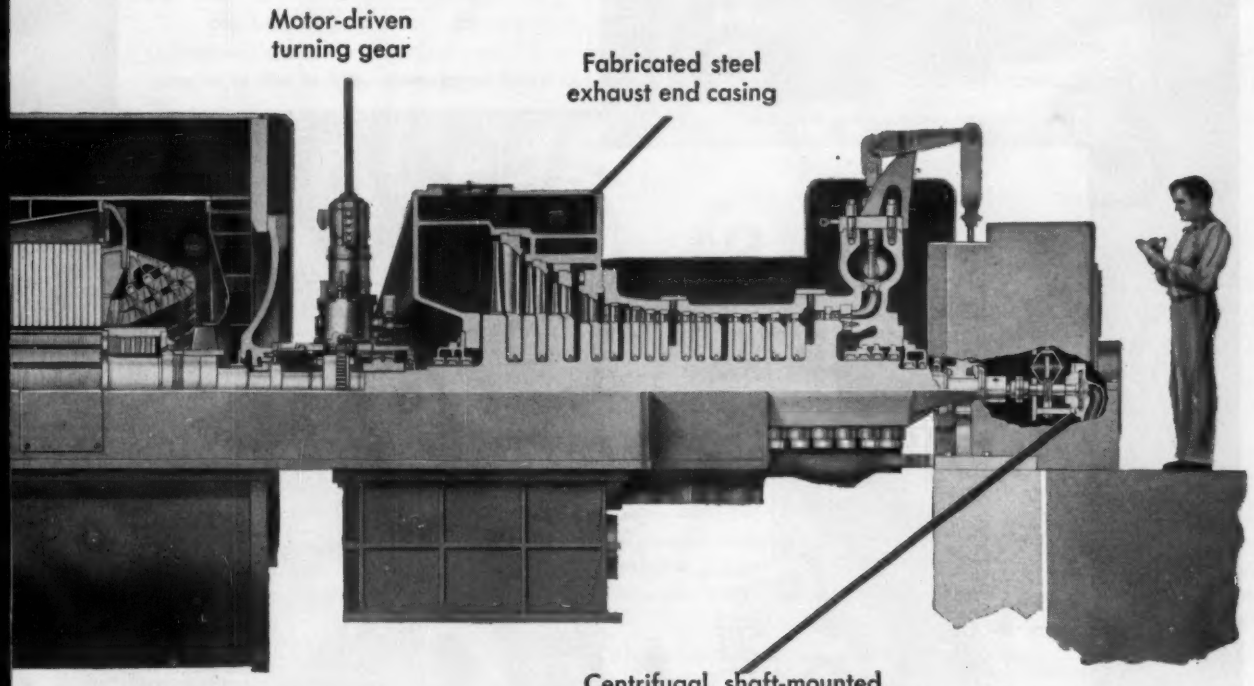
NEW Large WA-Series Turbines Offer

Advanced ● Design Features **Simplified ● Installation** **AIEE-ASME ● and NEMA Ratings**

NEW WA-Series steam turbine-generator units now being manufactured include the 10,000-kw NEMA standard rating as well as 12,650-kw and 16,500-kw AIEE-ASME preferred standard condensing ratings. The 16,500-kw units have hydrogen-cooled generators.

Incorporated in the design are time-proved labyrinth steam sealing, removable external glands, high chrome alloy steel buckets and nozzles, reliable governing system, and unit shipment and installation — plus additional large turbine and generator features.

To get MORE information on economical, dependable units 2000 kw and larger, call the nearest A-C district office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.

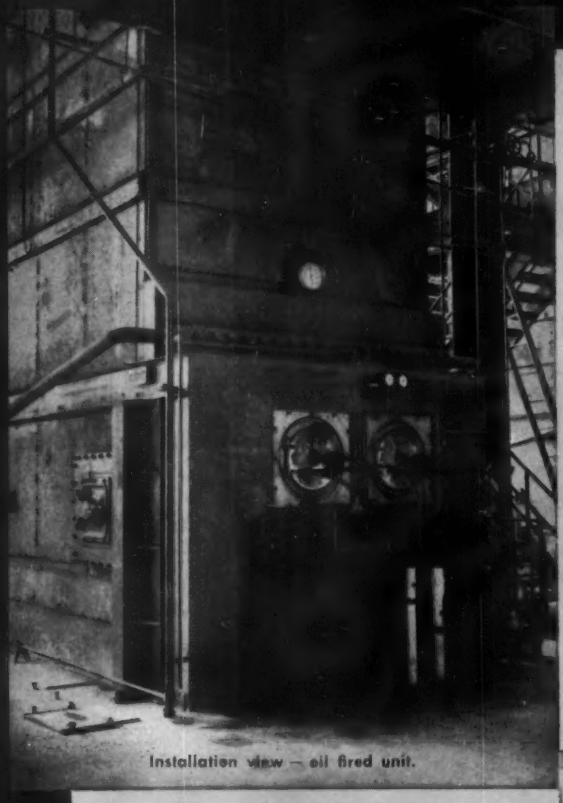


CHALMERS

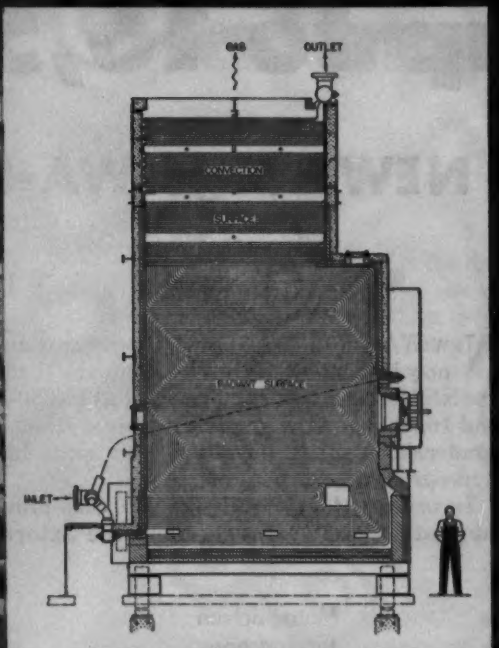
LIVE BETTER ELECTRICALLY

A-5127

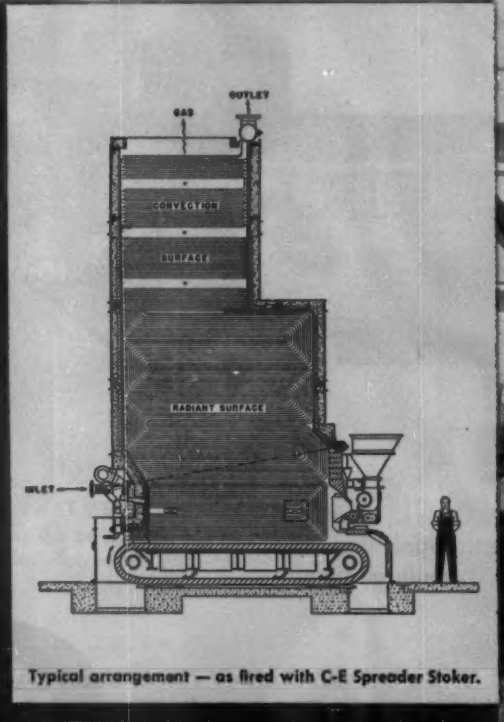
C-E LaMont Controlled Circulation Hot Water Boilers



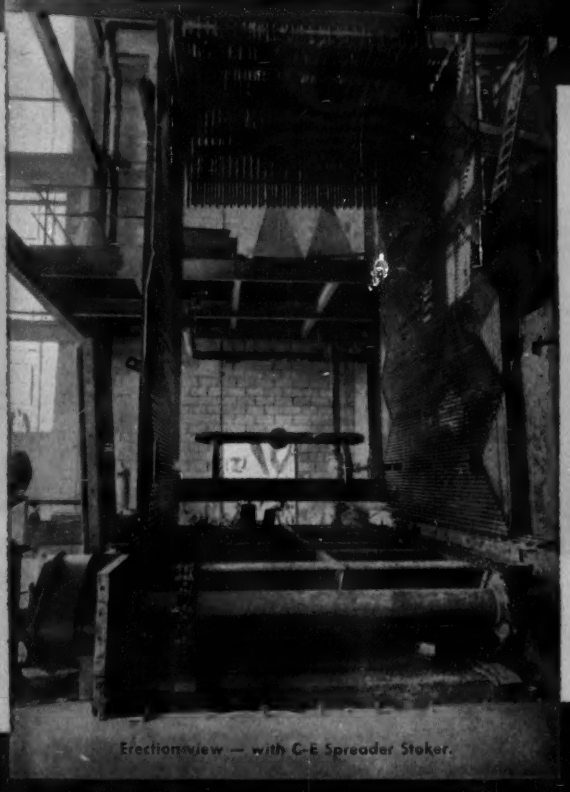
Installation view — oil fired unit.



Typical arrangement — as fired with oil or gas.



Typical arrangement — as fired with C-E Spreader Stoker.



Erection view — with C-E Spreader Stoker.

How about HIGH TEMPERATURE WATER *for your heating or processing needs?*

Both steam and high temperature water have their place, and your particular requirements will determine which is best for you. In either case, the complete C-E line includes a type and size of boiler exactly suited to your needs. Where high temperature (HT) water seems indicated, it affords such important advantages as:

1. **The higher available heat in HT water — many times that of steam at the same pressure.**
2. **Closer control of temperature.**
3. **Heat loss is lower with the HT water closed system . . . unused heat returns to the boiler . . . no condensate return lines.**
4. **No elaborate feedwater treatment required. Make-up requirements are exceptionally low.**
5. **Steam traps not required — trap problems and attendant expense are eliminated.**
6. **No blowdown losses . . . no safety valve vent losses . . . no condensate losses.**

The planning of any new heating and/or processing system should include the consideration of a high temperature water system. There are many hundreds of HT water installations operating abroad and a rapidly growing number in the U. S. A. It may be *just right* for *your* requirements.

B-886 C

Advantages of the C-E "HT" Water Boiler

Once it is established that HT water is right for your needs, your next concern is selection of proper equipment. The C-E high pressure, high temperature water boiler has inherent advantages that make it the best possible choice. It is especially designed for HT water applications utilizing as it does the principle of forced, controlled circulation which is extended throughout the entire system. This accounts for numerous points of superiority in the C-E LaMont Controlled Circulation Hot Water Boiler. Among these are:

1. **Complete control over HT water movement in both system and boiler.**
2. **No separate boiler pump is required, since low pressure loss is inherent.**
3. **Pressurized operation with oil or gas means no induced draft fan.**
4. **Single-pass design — no baffles — means cleaner boiler and lower draft loss.**
5. **More efficient heating surface can be arranged because of controlled, positive circulation.**
6. **Any fuel — oil, gas, coal, or any combination of fuels.**
7. **Other features such as: gastight, welded steel casing . . . fewer headers, all of which are accessible.**

The C-E LaMont Controlled Circulation Hot Water Boiler is available in sizes ranging from 10 to 200-million Btu per hour, or more, with pressures up to 500 psi and temperatures to 475 F — higher if required.

If you are in the market for a heating or process system — or expect to be — by all means investigate high temperature water and the C-E "HT" Water Boiler. Our engineers will be pleased to discuss the subject with you or your consultants. Write for our new catalog HT-112.

COMBUSTION ENGINEERING

Combustion Engineering Building • 200 Madison Avenue, New York 16, N. Y.

CANADA: COMBUSTION ENGINEERING-SUPERHEATER LTD.

STEAM GENERATING UNITS; NUCLEAR REACTORS; PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; DOMESTIC WATER HEATERS; SOIL PIPE

NEW! "BUFFALO"

a new high

MOST STREAMLINED INLET — note smooth inlet bell matching the deep drawn wheel flange to form a "true half circle" inlet into wheel.

DEEPER BLADES FOR DEEPER "BITE" — note exceptionally deep blade design in photo below. This improves air flow thru blade channels. Flanged hubs—smoothly curved for best air entry conditions.

The wheel has been dynamically tested in the "Buffalo" Vacuum Pit — possible only at "Buffalo". By spinning various rotor designs to destruction the optimum wheel construction was determined — another "Buffalo" "Q" factor.*

"Buffalo" Air Foil Wheel. Note "deep-bite" blades for most efficient air handling.

BUFFALO* *The "Q" Factor — the*

BUFFALO,

Canadian Blower &

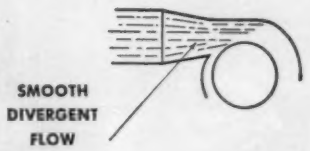
VENTILATING AIR CLEANING AIR TEMPERING PRESSURE BLOWING

"Deep Blade" AIR FOIL FANS

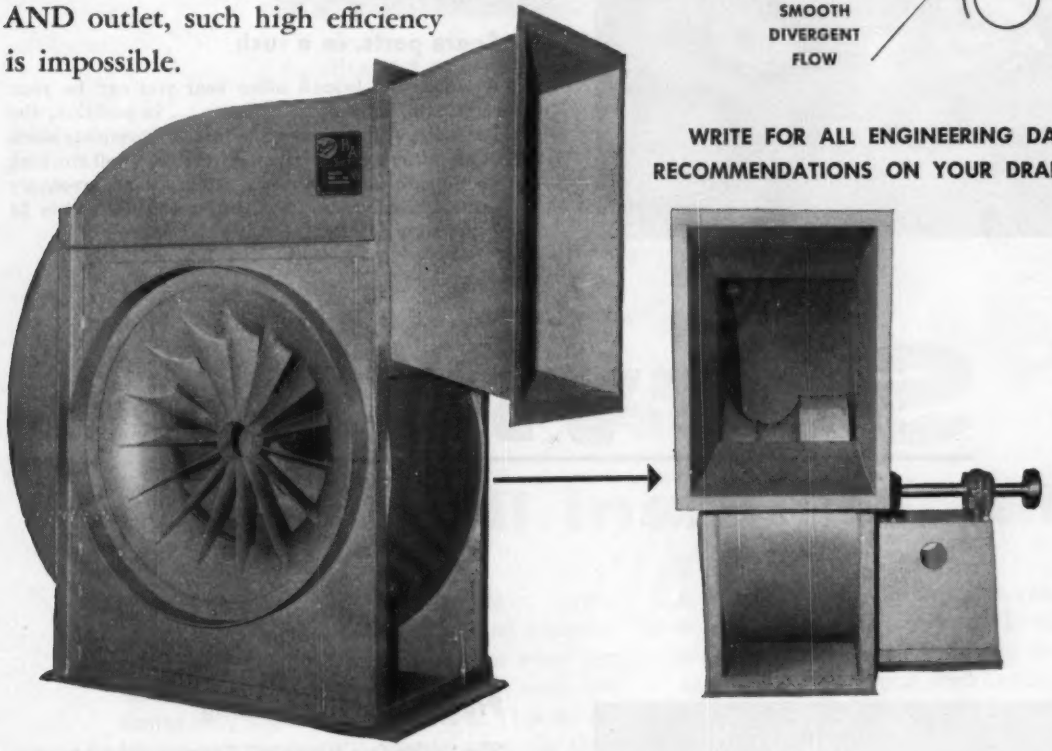
in forced draft performance

IMPROVED FAN OUTLET — reduces outlet air turbulence from fan cutoff into duct by making more even, gradual change from velocity to static pressure. Without this complete streamlining of inlet, housing AND outlet, such high efficiency is impossible.

92% MECHANICAL EFFICIENCY — not an inflated claim, but proved performance you can expect in field operation.



WRITE FOR ALL ENGINEERING DATA AND RECOMMENDATIONS ON YOUR DRAFT PROBLEM



built-in Quality which provides trouble-free satisfaction and long life.

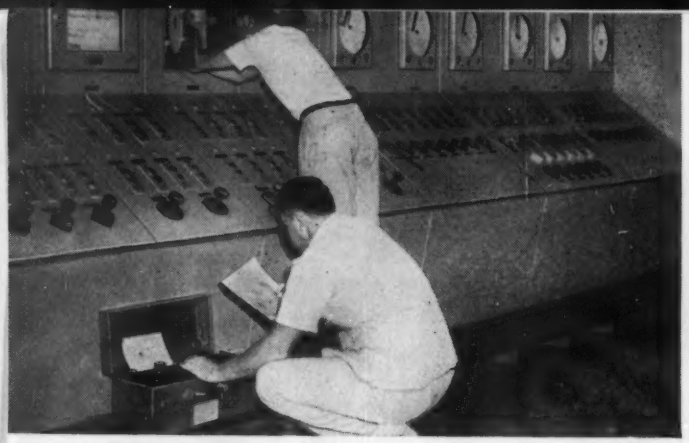
FORGE COMPANY

"Buffalo"

NEW YORK

Forge Co., Ltd., Kitchener, Ont.

INDUCED DRAFT EXHAUSTING FORCED DRAFT COOLING HEATING



Maintenance engineering

You can arrange to have a Honeywell service engineer visit your plant at regular intervals to inspect, clean, and adjust your instruments and controls. He's factory-trained and field-experienced in keeping good instruments in top operating condition. If an emergency should arise, a phone call will bring a Honeywell service engineer to your plant in a hurry.

Spare parts, in a rush

A Honeywell branch office near you can be your storeroom for standard parts . . . in addition, the Parts Depot in Philadelphia carries a complete stock of all normally used parts. With Honeywell stocking your spare parts, you save storage and inventory control costs. Most shipments are made within 24 hours after orders are received.

Service is the

Practical service training

The tuition-free Honeywell Training School teaches your instrument technicians the most up-to-date maintenance methods, fits them for the kind of problems they may encounter on the job. Intensive courses range from two to fourteen weeks.

Application engineering

Experienced Honeywell application engineers know your industry and processes. They design *complete* systems of instrumentation, reducing the work of your own engineering staff. From the broad Honeywell line, they recommend instruments that are exactly right for the job. And because Honeywell supplies all types of instruments, recommendations are made without bias. Service engineers will, if needed, help with installation and startup of your system.

big extra you get with Honeywell instrumentation

Honeywell offers you far more than instruments. You get service whenever and wherever you need it . . . service that begins when you first decide you need instruments, and continues long after they're installed. This service is always conveniently close at hand, for there are more than 110 Honeywell sales and service centers located strategically throughout the U. S. and Canada.

Prompt, competent service by nearby field specialists is an important plus-value of Honeywell instrumentation. Your local Honeywell sales engineer has all the facts on this service as it relates to your instrumentation needs. Give him a call . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

MINNEAPOLIS **Honeywell**

BROWN INSTRUMENTS

First in Controls

Another Feature of the FW Series "SC" Standard Boiler

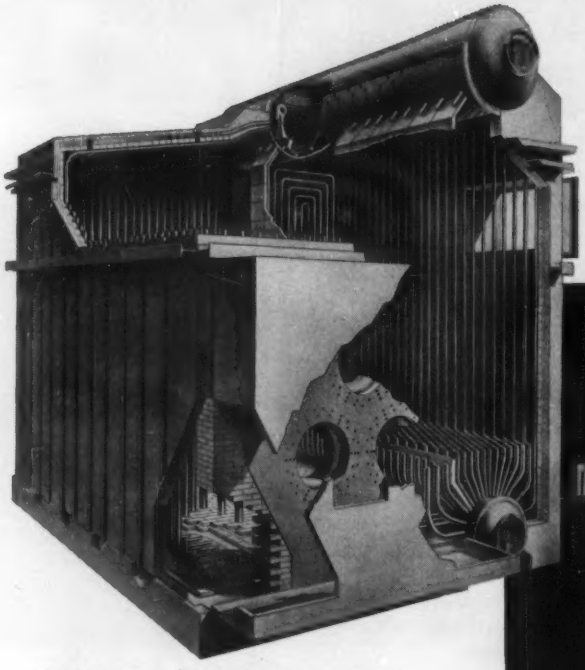
PRESSURE-TIGHT CASING

permits

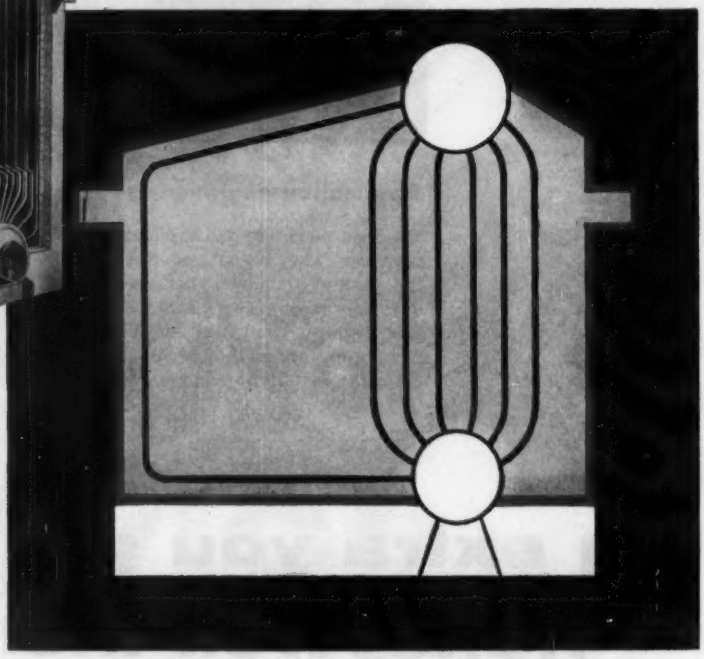
LOWER OPERATING COST

through

MORE EFFICIENT COMBUSTION



Cut-away view of Foster Wheeler "SC" Series Standard Steam Generator



OTHER FEATURES AT A GLANCE

- Completely water-cooled walls
- Over 19-foot firing depth
- Unrestricted circulation
- Fully drainable superheater
- Efficient convection surface
- Bottom supported unit
- Steam purifying system
- Full insulation

THE ALL-WELDED steel casing of the Foster Wheeler Series "SC" Steam Generator forms a rigid, pressure-tight unit which can be arranged for either pressurized or balanced-draft operation.

By eliminating all possible sources of air or gas leakage, this pressure-tight design increases combustion efficiency and contributes to higher fuel economy per pound of steam per hour. No sliding seals are necessary as the stationary casing is welded to the drums and the differential in expansion provided for by an integral horizontal expansion joint which encircles the entire unit. Pressure-tight ports are provided for observation of burners and flame.

These cost-saving FW Series "SC" Steam Generators are available in capacities from 50,000 to 150,000 lb/hr, for pressures to 1500 psi and superheated steam temperatures to 950F. For further information, write for Bulletin B-55-4. *Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.*

FOSTER WHEELER

NEW YORK • LONDON • PARIS • ST. CATHARINES, ONT.

NEW!

Major new development in bus conductor offers maximum protection against short-circuit forces in high-current systems.

Strong as a girder, easy to install, high in current-carrying capacity, Alcoa® Aluminum Integral-Web Channel Bus Conductor offers pronounced advantages over other types of conductor for such applications as generator leads, substation bus and industrial plant use.

Its integral-web construction eliminates need for spacer clamps or welded bars across channels. The special extruded shape gives a large surface area to accommodate high current in either ac or dc circuits. Its high section modulus provides the mechanical stiffness needed to resist the forces of short circuits without damage or distortion.

Joints, taps and splices can be clamped, bolted or welded. Special grooves mark exact center lines for drilling bolt holes so that nuts lock in recesses designed to eliminate back-up wrench. Channels, plus vent holes in center web, provide high degree of ventilation, cooling and drainage.

For complete information, contact your Alcoa repesentative or write Aluminum Company of America, 2312-K Alcoa Building, Pittsburgh 19, Pa.

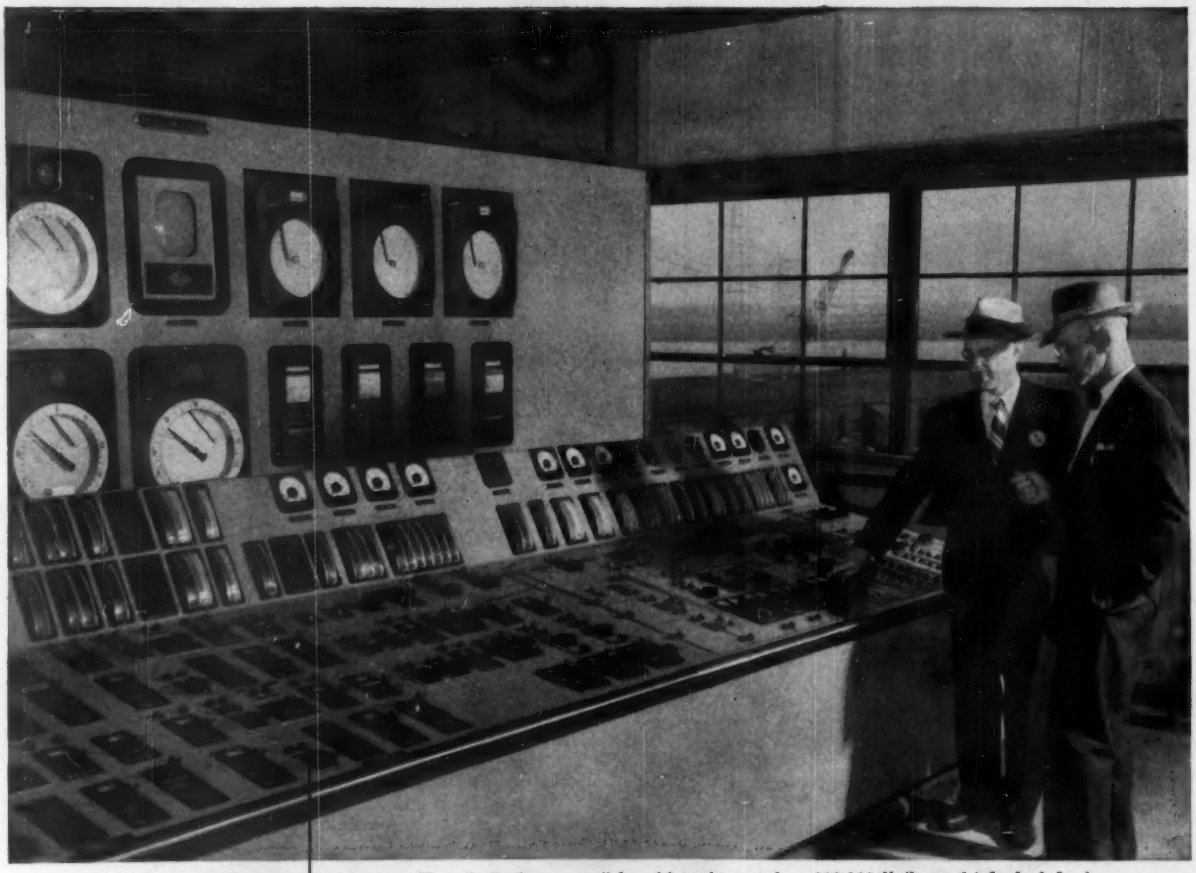
SIZES	NOMINAL CURRENT* (amperes)
4 x 6	3,500
5 x 6	4,000
8 x 8	7,000
11 x 11	10,000
12 x 12	12,000

*(based on 30° C rise above 40° C ambient still air)

THE ALCOA HOUR
TELEVISION'S FINEST LIVE DRAMA
ALTERNATE SUNDAY EVENINGS

ALCOA ALUMINUM
ELECTRICAL CONDUCTOR
ALUMINUM COMPANY OF AMERICA

Your Guide to the Best in Aluminum Value



At Jersey Central Power and Light

A unique Hays built "two story" benchboard controls a 900,000 lb/hr multiple fuel fired boiler. Necessary control stations and miniature indicators are consolidated in a small space for one man operation, yet are easily accessible from inside the panel for servicing.

NEW DIMENSIONS IN COMBUSTION CONTROL

Dramatic results are being achieved by the nation's top

Today's boiler plant is only as efficient as the instrumentation which operates it. In selecting the correct equipment to assure completely automatic operation, to provide cost reductions through labor saving, and greater efficiency, the companies shown on these pages have looked to Hays. The newest in power plant design coupled with Hays workmanship and follow-through have given them the results they sought.

SKILLED FACTORY ENGINEERING

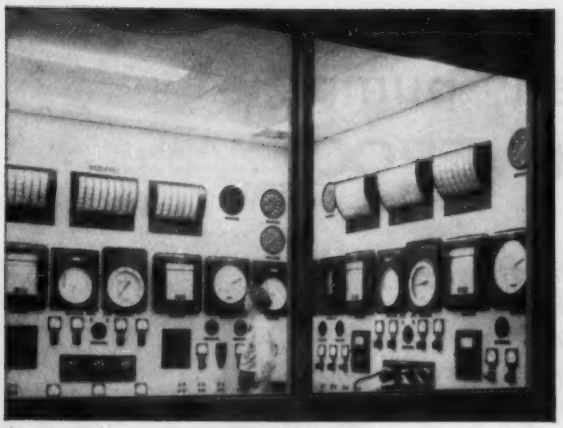
Hays systems are engineered to your specific requirements by a staff of specialists with years of experience on hundreds of boiler plants from the smallest to the largest. The particular instrument and control "package" necessary to handle your conditions is selected from the Hays product line; panel design, complete wiring, conduit, piping and control system diagrams are closely checked to see that they fit your requirements.

NATIONWIDE SERVICE

Service on Hays products is available throughout the country. Trained service engineers, from the factory or from Hays representatives in principal cities, can provide "start up" calibration and adjustment as well as subsequent periodic preventive maintenance service on your equipment.

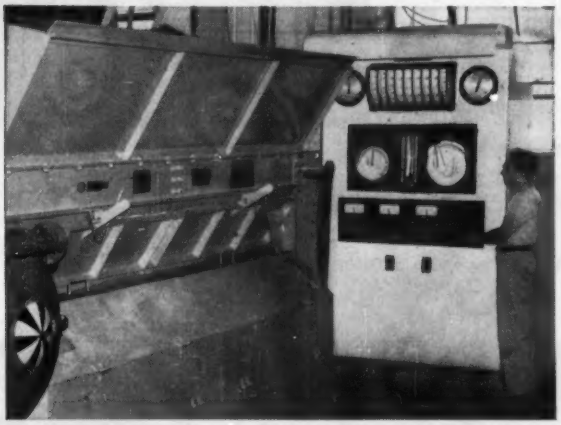
For best results you will want to confer with Hays Sales Engineers in the earliest stages of your planning.

Write for complete information. Bulletin 55-605-83.



At Northern Indiana Public Service, the Hays system permits any desired allocation of load among three boilers, between the two cyclone furnaces of a given boiler and between the two fuels (coal and gas) being burned simultaneously in a given cyclone.

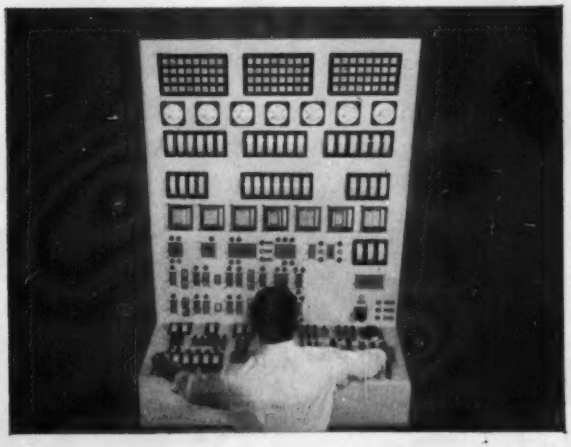
At Baldwin Locomotive Works, the Hays combustion control has aided substantially in saving 30,000 tons of coal per year and in reduction of maintenance. It is now possible to operate the power plant with 42 less men.



At Falstaff Brewing Corporation, modernization and Hays metering type control have resulted in boiler efficiency of 82%, fuel cost reduction of several hundred dollars per month, CO_2 up from 6% to 12%, and maintenance costs lowered 65%.

At Morton Salt Company, Manistee, Michigan, the fact that electricity doesn't freeze is vital in this semi-outdoor boiler which handles load swings up to 80,000 lb/hr at 85% efficiency with help of Hays electrically operated combustion control system.

utilities and manufacturing companies



At Louisiana Power and Light, a compact Hays B. T. G. control panel only 4 feet wide controls a giant 1,000,000 lb/hr boiler, turbine and generator! Instrumentation and control by Hays includes new electronic mercuryless flow meters and other electronic instruments for greater speed and accuracy.

THE

hays

CORPORATION

MICHIGAN CITY 3, INDIANA

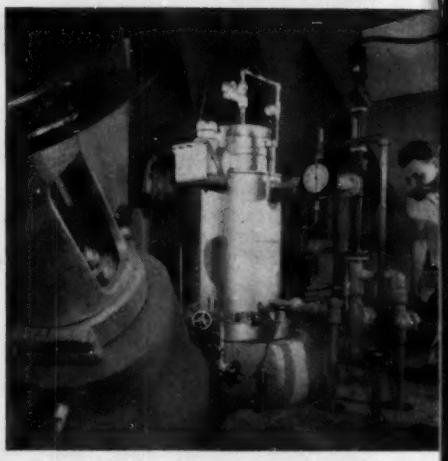
Automatic Combustion Control • Varriflow Meters and Varitrol • Electronic Oxygen Recorders • CO_2 Recorders Boiler Panels • Gas Analyzers • Combustion Test Sets Draft Gages • Electronic Flowmeters • Miniature Remote Indicators • Electronic Feed Water Controls

Westinghouse "canned" pump eliminates leakage at VEPCO

Zero leakage! No injection water sealing required. Pump may be kept on hot or cold stand-by. No seal maintenance. Windings protected by nickel "cans" welded in place. No bearing lubrication.

These are advantages realized by Virginia Electric Power Company with the installation of a Westinghouse "canned" motor pump in the controlled circulation boiler system of the new Possum Point Station.

VEPCO, Stone & Webster and Combustion Engineering pioneered the power station application of this pump which was first developed to handle radioactive fluids in nuclear reactor loops. All the development work is now complete and the installation has been in actual service at Possum Point for over a year. J-57005



Westinghouse "canned" pump in Combustion Engineering controlled circulation boiler at Virginia Electric's Possum Point Station.

WATCH WESTINGHOUSE!

COVER THE PRESIDENTIAL CAMPAIGN ON CBS TELEVISION AND RADIO!

LOUIS N ROWLEY, EDITOR • OCTOBER 1956 • ESTABLISHED 1882 **Power**

Fire prevention: Your responsibility

EVERY YEAR between 30,000 and 40,000 fires occur in manufacturing plants. Not all of these are big, of course. But in 1955, the average loss for each of 78 major industrial fires in the U.S. and Canada came close to $1 million. And in a typical year there is an industrial fire costing at least $250,000 each day of each working week.

A key fact for plant-service engineers to think about is that more than half of the major fires were detected without delay. How is it, then, that they got out of control?

The National Fire Protection Association lists these as some of the reasons: (1) Delay in notifying the fire department, often because of undue optimism about local firefighting efforts. (2) Lack of plant fire brigades, or brigades that are inadequately trained and equipped. (3) Poor housekeeping and poor building design that speed the spread of fire once it starts. (4) Absence of sprinkler systems in an amazing number of cases, and too many instances of sprinklers that were out of order or turned off.

Looking at these records, Byron J O'Hara, vice-president of Buffalo Fire Appliance Corp, makes some points of direct and immediate concern to plant-service men—points to be considered in making sure your plant's guard is always up.

Fire protection starts with equipment like sprinklers and extinguishers, with organization of well equipped and trained fire brigades. But, warns O'Hara, the best equipment is of no avail if it isn't properly maintained, or if the men who use it are ill-informed. For there is one insidious thing about fire—it seems so unlikely to strike that we tend to relax our vigils. Even the weapons that snuff out almost a third of all industrial fires—approved portable extinguishers—are often neglected.

Now, as Fire Prevention Week reminds the nation of the ever-present fire menace, let's look to our plans to prevent and fight fire.

Prevention starts with good building design that avoids large open spaces without dividing walls, that has protected openings for conveyors, etc, and that has sprinkler systems designed for the specific hazards involved. And prevention includes good housekeeping: proper precautions in handling flammable liquids, avoidance of dust and rubbish accumulations and the sparking conditions that often ignite them.

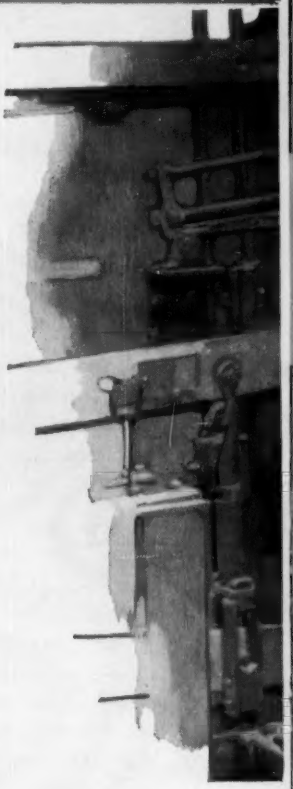
Ability to hold down fire loss depends on protective equipment and fire brigades, but even more importantly on everlasting vigilance. Personnel must be kept constantly alert to the hazard of fire, constantly skilled in their firefighting tasks. And every bit of protection equipment—from sprinkler systems to the hand extinguishers that represent front-line defense—must be tested and maintained in constant readiness.

If we discharge these basic responsibilities we can go a long way to keeping fire from striking in our plants. Remember: Seven out of every ten companies severely hit by fire are forced to close their doors in failure within three years.

"We had as many as 24 Solenoid coils a month burn up before we installed BUSS FUSTATS" . . .

"Now our burned up coil losses are negligible."

C. R. Babcock. CHIEF ELECTRICIAN
DEWEY PORTLAND CEMENT CO., DAVENPORT, IOWA



Mr. Babcock continues ——

"The burning up of the solenoid coils that activate the plungers that dump our weighing scales was a real problem with us. We lost as many as 4 coils on one 8 hr. shift. The maximum was about 24 coils a month.

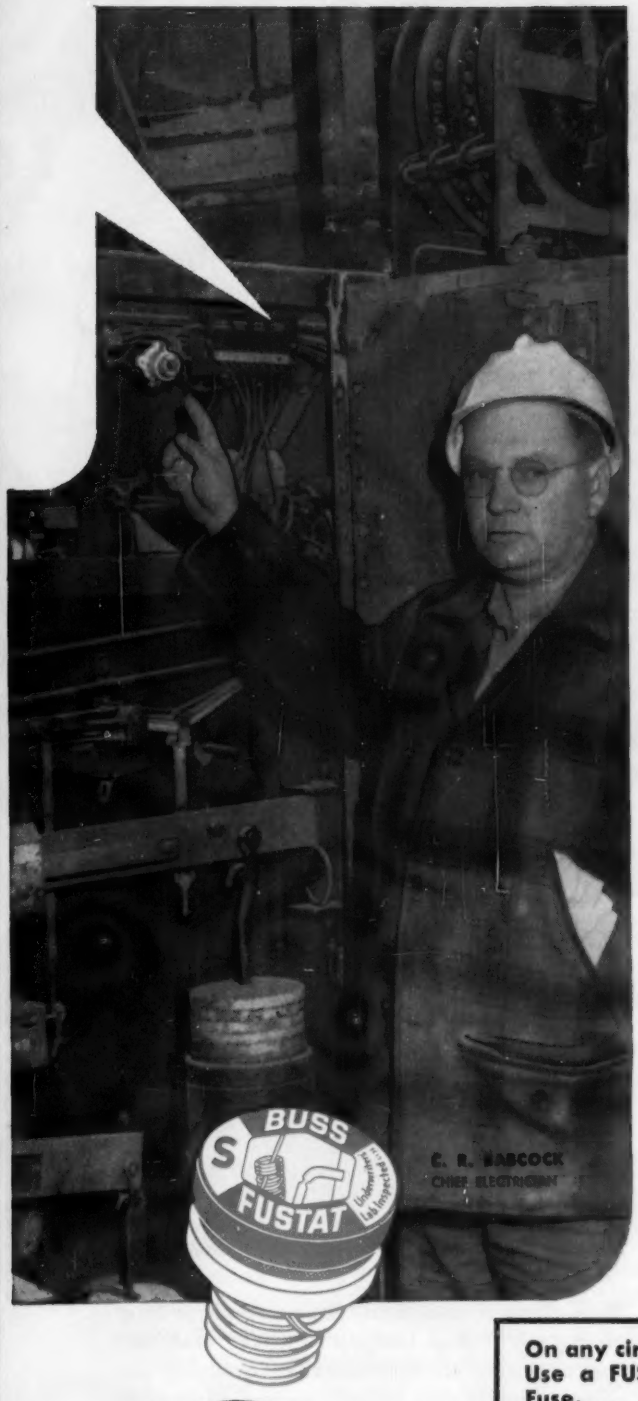
"Trouble develops on the days when the gypsum for our cement picks up moisture and sticks to the scales. Then the counterbalance can't reset the scale and, as a result, the plunger moves up and down energizing and de-energizing the thrust coil. The coil has only a few turns of large copper wire and draws a heavy current each time it is energized. It heats up quickly and burns up.

"To give over-load protection to the thrust coil, which is on a 125 volt DC power supply, we installed a 3.2 BUSS Fustat in a series with the coil. (BUSS Fustats are FUSETRON dual-element fuses with a type S base for use on circuits up to 125 volts.)

"Now, when there is trouble the Fustat opens before the coil is damaged. The scale is cleaned and another Fustat installed. We are then back in operation.

"We have three of these scales and at the present time we are replacing only about one coil a month and this is generally due to mechanical and moisture damage.

"We figure BUSS Fustats save us money in two ways — by practically eliminating the cost of replacing solenoid coils — and by greatly reducing our down-time losses."



On circuits of 125 volts or less —

The Proper Size BUSS Fustat can Reduce Danger of Burnout of Solenoids, Coils, Transformers and Motors

A BUSS Fustat is a Fusetron dual-element fuse with a type S base for use on circuits of 125 volts or less. A Fustat gives all the protection of a fuse against short-circuits or dangerous overloads — yet, it permits circuit to be loaded safely to maximum capacity.

Protecting Solenoids, Coils and Transformers —

By installing the proper size Fustat, a solenoid can be protected because the Fustat will not open on the operating surge but will open in time to protect, should the heavy current continue too long for any reason.

A transformer or coil, likewise, can be protected because the long time-lag of the Fustat permits it to hold all normal current surges and harmless overloads — yet it will open to prevent burnout on any dangerous overloads.

Protecting Motors against burnouts —

A BUSS Fustat of motor-running protection size mounted anywhere in the circuit to handle ONLY the motor current will give finest available protection against burnout of the motor.

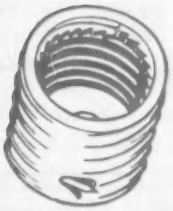
Nothing else is needed. Underwriters' Laboratories listing gives Fustats same degree of approval for both motor-running and short-circuit protection as the most expensive devices made.

BUSS Fustats stop dangerous practice of tampering or overfuseing

The type S (tampering resisting) base of a Fustat prevents anyone replacing them with an ordinary fuse, a penny or other substitute — or with a size too large to protect.

Fustats fit ordinary Edison base fuse holders through use on an inexpensive adapter that once installed need never be replaced.

Write for bulletin SMPS.



On any circuit up to 600 volts — Use a FUSETRON dual-element Fuse.

Fusetron fuses protect motors, solenoids, coils and transformers against burnout; they offer maximum safety because of their 100,000 amp. interrupting rating; they help increase production by eliminating needless blows and they cut maintenance costs because they are maintenance free.

Write for bulletin FIS . . .

For loads above 600 and up to 5,000 amps. — Use BUSS Hi-Cap Fuses.

When coordinated with Fusetron fuses they will not open ahead of the fuse nearest fault . . .

Write for bulletin HCS.

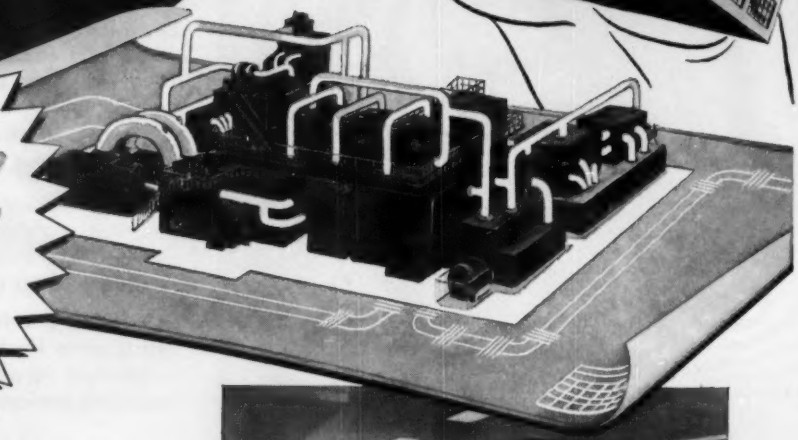
Play Safe! **Install BUSS Fustats, FUSETRON Fuses and BUSS Hi-Cap Fuses throughout entire Electrical System!**

Bussmann Mfg. Co. (*Division of McGraw Electric Co.*)
University at Jefferson, St. Louis 7, Mo.

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

ENGINEERING at *Pittsburgh Piping*

another
P. P. & E. service
which contributes to
Improved
HIGH-TEMPERATURE
HIGH-PRESSURE
PIPING



We have complete facilities for all piping fabricating operations, heat-treating, inspection, and testing procedures. Illustration shows machining of bevel on end of 36" O.D. plate welded turbine cross-over piping assembly.

Pittsburgh Piping engineers study the plant designer's piping layouts, check all details and specifications. To assure quality, economy, and speed a maximum amount of each piping job is planned for prefabrication in our shops.

We assume responsibility for every phase of a piping job — from blueprint through erection. Our engineers are specialists — thoroughly experienced in the theoretical and practical aspects, as well as in the code and insurance requirements, of high-temperature, high-pressure piping.

PRODUCTS AND SERVICES

Carbon Steel Piping	Forged Piping Materials
Cast Iron Fittings	Headers
Cast Steel Fittings	Manifolds
Chrome-Moly Piping	Pipe Bends
Copper Piping	Stainless Steel Piping
Corrugated Piping	Van Stoning
Creased Bends	Welded Assemblies
Expansion Bends	Welded Stainless Steel Tubing
Flanges	Welding Fittings

PP-21

Pittsburgh Piping
AND EQUIPMENT COMPANY
158 49th Street — Pittsburgh, Penna.

CANADA: CANADIAN PITTSBURGH PIPING, LTD.
835 BEACH ROAD — HAMILTON, ONTARIO

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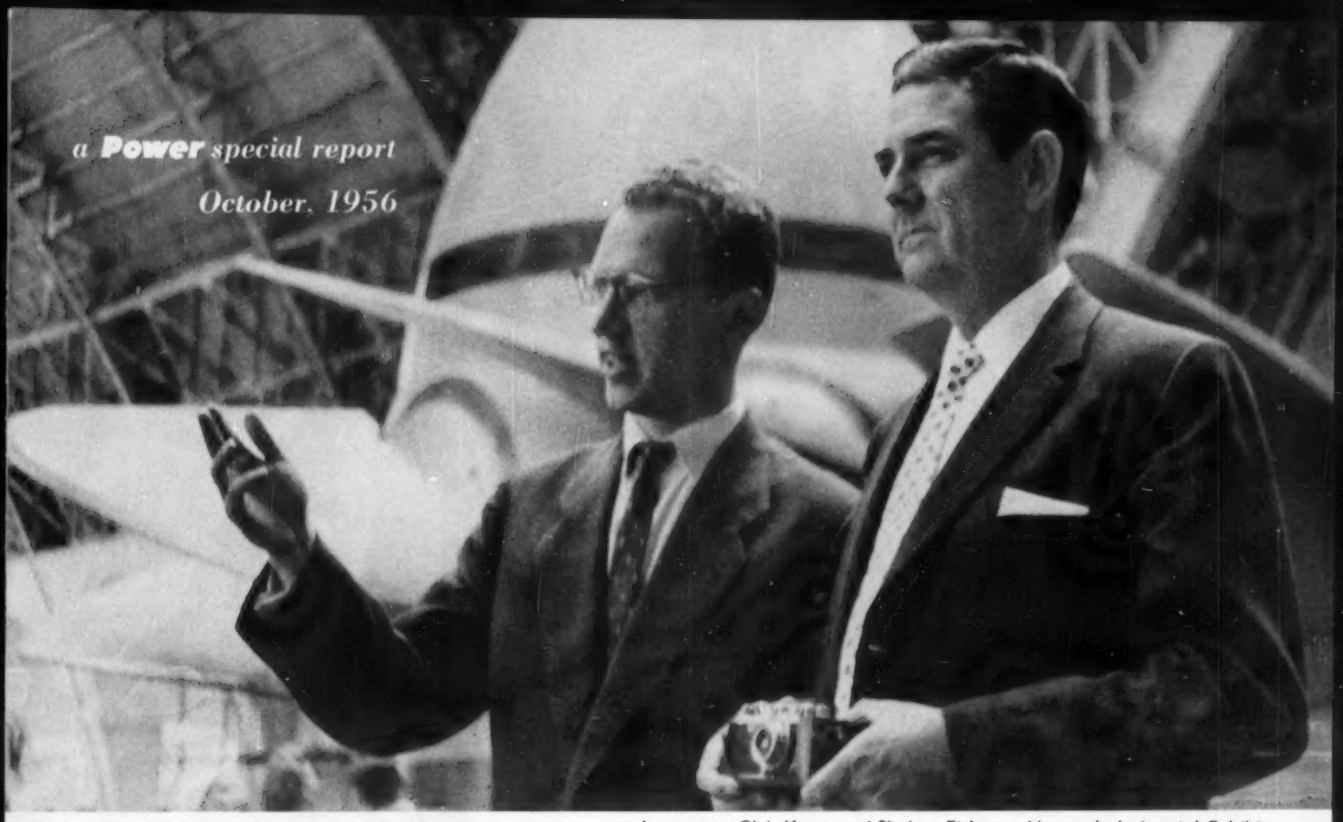
Syracuse	113 So. Salina Street
Toronto	68 Yonge Street



Interpreter Gleb Kosov and Shelton Fisher at Moscow's Industrial Exhibit

A first-hand appraisal:

Soviet Power Today

"Soviet power is communism . . . plus electricity"
LENIN

The Soviets know what power is all about. Lenin's remark, one of the best known in the Communist Party lexicon, was made when Russia's output was 2 billion kwhr. Today it is 170 billion.

The Communists knew from the start in 1917 that their primary industrial job was to create sources of mechanical energy to take the work load of a nation off the backs of the people. That is still their job, because they are far from possessing adequate power. And they still know it.

Soviet Russia's power production of 170 billion kwhr in 1955 compares with the total output of the U. S. in 1939. But when this is put on a per-capita basis, it compares with the kwhr available to each person in the U. S. back in 1927.

Even this does not tell the full story. The Russians still have ahead of them — in housing, for example — the work of past decades, already accomplished in most countries of the western world, but barely begun in the USSR. So the Soviets' need for power is still enormous.

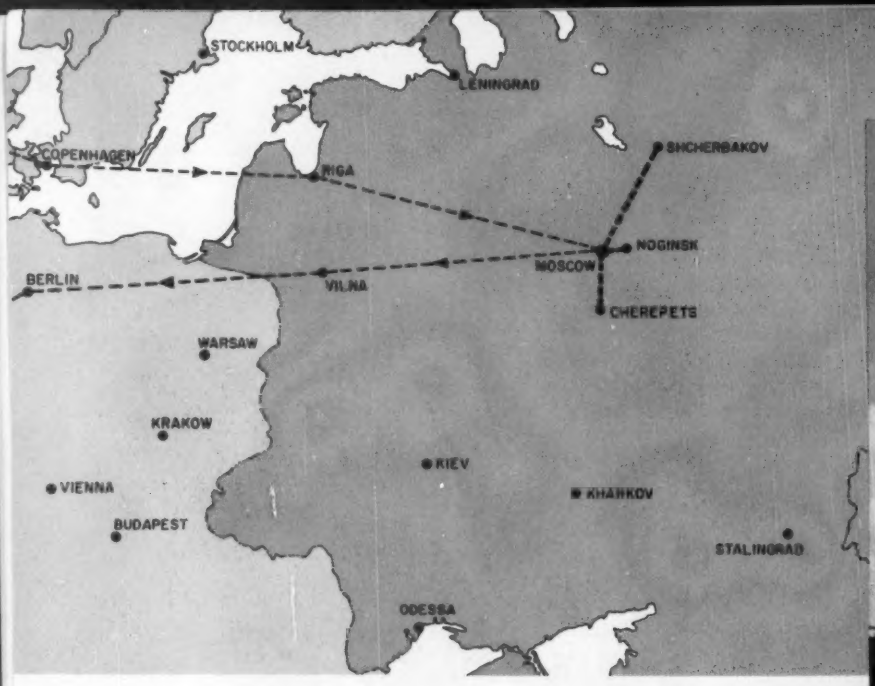
On the staff of POWER we have known some of these things about the USSR for a long time. Our curiosity about their progress has brought in some figures from time to time, but seldom with reliability, and almost never in detail. We have felt similar curiosity from readers, from U.S. power-equipment manufacturers, from all those who best know that the real strength of any modern nation lies in its ability to replace manpower with *hp*.

Earlier this year it seemed that the softer voice with which the Soviets were speaking to the world, and the apparent easing of restrictions, gave some promise of an opportunity to get first-hand information at long last. But would Soviet policy, even if relaxed in other areas, permit a look at their industrial heart: the power field?

It did, and the result was an informative inspection of USSR power facilities, a look at their future plans, and a good glimpse of the face of Russia, after 40 years of Communism.

Although the following pages attempt a clear and honest report on Soviet power practice as their primary message, here and there you will find editorial comments of a more general nature. These asides, it seems to me, are necessary to any report on the USSR today. For, if we are to understand the Russians, and find a way to share this planet with them, it is no more important to comprehend their machines than to understand their people . . .

SHELTON FISHER, Publisher



"From the West, there are three principal ports of entry to the Soviet Union today. They are Copenhagen, Stockholm, Helsinki. I chose to fly from Copenhagen . . "

St Basil's in Red Square, Moscow

"My plane reached Moscow at 12:45 AM..."

On March 27, 1956, I addressed a personal letter to Georgi M Malenkov, former Premier of the USSR and now Minister of Power Stations. This letter said that POWER would like to inspect Soviet generating facilities, to determine Russia's growth and ambitions in this field, and thus be the first U. S. technical publication to give an eyewitness report of a vital area of the Soviet economy.

This letter was submitted to the Soviet Embassy in Washington. After weeks went by with no reply, I applied for a visa, which is still needed for all countries of Eastern Europe, thinking this would produce a reply, one way or another. The visa was granted almost at once, with assurances from the Embassy that I could expect a "good reception" in Moscow. But still no word from Malenkov.

Taking the calculated risk that my arrival in Moscow might be unexpected, I accepted the visa and made preparations for the journey. Then, at almost the last minute, a letter came from the Ministry of Power. It promised a welcome, said that details of my visit would be furnished in Moscow. So I took off with good hope that the long trip would prove worthwhile.

THE NEW LOOK

From the West, there are three principal ports of entry to the Soviet Union today. They are Copenhagen, Stockholm, Helsinki. I chose to fly from Copenhagen, via Scandinavian Airlines, which has been operating to Moscow since June of this year.

The Danish customs officer stamped my U. S. passport, looked at the Russian visa. He said, "Do you have a camera in your hand luggage?" I said, "Yes." "Please put it in your checked baggage," he replied. I thought, "Here goes freedom. Things will get tighter and tighter now. How far will it go?"

That was the last restriction put on me until I left Russia two weeks later. No one examined my luggage, going in or coming out. On entering the USSR, at Riga, Latvia, I was asked how much money I had; when I left Moscow, no one mentioned money, or even asked about the camera. I was to take some 500 photographs. I wrote countless letters and postcards — all got through without delay. No one even asked to see my notes. I roamed the streets of Moscow apparently "unobserved."

This is all brand new, of course. Almost none of it was possible one year ago. That is why American residents in Moscow, who can measure these changes best, find them almost bewildering, believe there is more to come.

And yet it is not enough. It is not enough to prevent a lone traveler, as I was, from *feeling* freedom, in a way that cannot be described, when once you touch down on Western soil again. The Soviets refer to these as "new days," but it is going to take many new days to blot out the old years of suspicion and surveillance.

It is going to require something else. It is going to require a legal structure for society that will give the visitor, no less than the Soviet citizen, certain rights on which he can count. So long as power is absolute in the USSR, real peace of mind cannot be.

At the Power Ministry: Vladimir Yermakov, 1st Deputy is at my left; back to camera is Nicholai Galotchkin, my host

I say this, as much for the Russians to read, and they surely will, as for the regular audience of POWER. Because I believe the Soviets are completely sincere in their desire for more exchange with the United States, whatever their long-range motives, and they should understand the obstacles to that exchange. I said this while still in Moscow and mention that fact here, not to indicate courage but rather to point out that it required no particular courage. It should be a part of my record that I, at least, was allowed very free speech in the USSR.

MOSCOW AT MIDNIGHT

My plane reached Moscow at 12:40 AM. It was raining. But at the foot of the plane's steps stood Nicholai P Galotchkin, Chief of Foreign Relations for the Power Ministry. He was to be my official host and he spoke excellent English.

At the end of a dark, one-hour ride to the Savoy Hotel in the center of Moscow, past huge Moscow University and the yellow walls of the Kremlin, Galotchkin proposed our first meeting at the Power Ministry. It was to be at 10 AM the following day.

The staff of POWER had prepared exactly 100 questions dealing with the problems and equipment of Soviet power systems. In all cases we gave the U. S. answers to the same questions. In addition we had collected a generous file of special reports from POWER, statistical booklets, etc., in all weighing 15 lb. The Soviets were later to give me 20 lb of technical data in return!

The first meeting was in the office of Vladimir Yermakov, 1st Deputy to Malenkov. Present were Galotchkin; Boris Lebedev, Chief of the Technical Section of the Ministry; S P Kashnikov, President of the Technical Publishing Division of three Soviet Ministries (Power Stations, Power Construction, Electric Manufacturing); Alexei Smirnov, Chief Editor under Kashnikov; and Gleb Kosov, my official interpreter for the entire visit.

My hosts were more than impressed by the 100 questions. They were flabbergasted. Galotchkin asked how many editors made up POWER's staff. I said twelve. How long did they work on the questions? I said a month. "But," he asked, "you hope we can answer them in ten days? There are not so many of us." I pointed out that it often took longer to prepare questions than to give answers, that many would be a part of our conversation and of my hoped-for inspections, and that, anyway, I would be satisfied with less than 100% success.

Then they gave me the plan for my visit. I was to see three stations never before shown to an American:

1. A new substation at Noginsk, 60 miles east of Moscow and part of a 400-kv grid system linking Moscow to the recently completed hydro station at Kuibyshev and, eventually, to the power systems of the Urals and Siberia.

2. The Shcherbakov hydro station of 150,000 kw, 250 miles north of Moscow, forming, with dams at Gorki and Stalingrad, the famous Volga system.

3. The still-building thermal plant at Cherepets, southeast of Moscow. Here 300,000 kw are operating, one 150,000-kw unit is being installed, another will be built in 1957, and total capacity will reach 1,000,000-kw.

I would inspect the power and atomic energy section of Moscow's newly opened Industrial Exhibit. There would be a banquet with the technical editors as my hosts, and, finally, it was announced that I was to interview Malenkov the following day at 3 PM.

Only once was this schedule changed. On the morning we planned to go to Cherepets at 7 AM, the phone rang as I was leaving my hotel room. It was Galotchkin to say that rain had "washed in" the Cherepets road. So, we would go to Shcherbakov instead.

I was to travel about 1200 miles by car, to see dozens of Soviet villages and thousands of Russian people. Out of Moscow, I was always accompanied, of course, and there were many hours of conversation about every subject of interest to them or me: Education in the US compared to USSR, 2-tone paint on US cars, the Soviet press, Eisenhower's health, Cinerama, U. S. jazz, Soviet jamming of broadcasts, chewing gum, and finally, even Stalin.

On the day that I saw Malenkov for the first time, someone said that this was his first business meeting with someone from "my country." If this is so, it would seem a good precedent is established for his next visitor. We met exactly at 3 o'clock, as promised.

"Malenkov waited . . . with hand outstretched . . ."

After only two days in the Soviet Union, I was already aware that the Russians will almost never precede you through a door or into a car. I was not prepared, however, to have to fight my own way into Malenkov's office. But I did. Because of the severe winters in Moscow, almost all windows have double sash, many offices have a storm-door arrangement. When Yermakov, Malenkov's first Deputy, bowed and waved me toward the doors of this private office, I found the first set opened outward, the second opened in. As I pushed through them, Malenkov waited alone, six feet away, with hand outstretched.

The office is about 35 x 18 ft, carpeted, simple but well furnished. Malenkov's desk is at the far end, over it the only picture in the room, Lenin's. To the left, a long table seats 15. Until the last minute, I think Gleb Kosov, my permanent interpreter, believed he would handle the interview. If so, he was probably relieved when V M Kouznetsov, apparently Malenkov's personal interpreter, took over. Kouznetsov was fast, excellent. At no time was translation a handicap or a nuisance.

Malenkov and I sat opposite each other, Yermakov to his left, Galotchkin to my left, with Kouznetsov on my right. Not once during the next three hours did Malenkov pass a question to his subordinates, only once did he refer to his notes. He talked smoothly, smiled and laughed freely, the entire interview was remarkably relaxed. It might have gone on another three hours had not courtesy persuaded me to terminate it at 6 PM. As we sat down there was no private talk between the Russians, Malenkov spoke to me directly. This is the substance of our conversation.

MALENKOV: I suggested this meeting to be at the beginning of your visit because I wanted to welcome you to the Soviet Union. How do you find Moscow?

FISHER: Since I arrived your associates have kept me so busy I have not yet seen Moscow.

MALENKOV: You must have seen some things, have an impression.

FISHER: It would be easier to tell you what I have not seen. I have not seen your subway, the Kremlin inside, the ballet, the puppeteers . . . and, incidentally, I will not see them, Mr. Malenkov, unless my visa is extended. They have cut me pretty short. Do you think that can be arranged?

MALENKOV: But it must be arranged . . . otherwise the puppets will say the Minister of Power Stations prevented Mr Fisher from seeing us. (*Turning to Galotchkin*) You can arrange that. (Galotchkin replied, "Yes it will be done.")

FISHER: I would like to make sure of our understanding here today. The things we are about to discuss will be published in POWER magazine. Is that correct?

MALENKOV: Of course.

Georgi M Malenkov, Minister of Power Stations

As last spring's news stories indicated, Georgi Malenkov was a hit on his visit to England. It is easy to see why. He is affable, has a quick and frequent smile, is probably the most Western, in manner and thinking, of the men now comprising the Presidium.

He stands 5 ft 7 in., probably weighs 180 lb. His appearance belies his photographs. He is actually not fat; his neck, face and shoulders are almost thin. His hair is brown and extremely fine. Around the outer iris of brown eyes is a ring of gray or dark blue, and there are many small wrinkles around the eyes. He speaks no English, does not smoke, his voice is soft and even.

Malenkov is a graduate of the Electrical Engineering Institute. He met his wife there as a student. Today, she is Director of that college. During the war, Malenkov was responsible for the large-scale transfer of Soviet industry from central Russia to points behind the Ural Mts. Today, he runs the Soviet atomic program, in addition to conventional power stations.

He is probably No. 3 or No. 4 man on the Presidium, has not slipped far from his previous spot as first Premier after Stalin. In Moscow it is not thought impossible that Malenkov might again rise to the top. This could even be in the normal course of events. It is pointed out that Khrushchev is 62, Bulganin 61, Malenkov is only 55.

FISHER: And if I decide to report on this interview to the American press, is that also permissible?

MALENKOV: Yes, there are no objections.

FISHER: I hope my original letter gave a clear idea of the general subjects in which POWER is interested. As you know, Mr Yermakov and I have agreed that this conversation will be based on that letter.

MALENKOV: Yes. Well, it takes in a large subject, this letter, but we will do our best with the answers to it.

FISHER: Mr Malenkov, two generating stations in the United States are now under construction that will generate steam at approximately 5000 psi and 1150 F. Are Russian engineers experimenting in this direction?

MALENKOV: Of course, we are experimenting in this direction, otherwise we will not be able to overtake and pass the United States.

FISHER: How far have you gotten?

MALENKOV: We have one test boiler, here in Moscow, developing pressure of 300 atmospheres (4400 psi). It is not generating electricity, it is for testing valves, piping, and other accessories. We know that this is the direction of progress, these higher pressures. But I would not say pressures of this size are within the near future in Russia.

FISHER: What do you consider the maximum capacities of your steam stations?

MALENKOV: In four to five years we will have five plants of 1,200 to 1,500 megawatts.

FISHER: Will I see one of those plants?

MALENKOV: You will see one of our newest plants at Cherepets. It is not of that size now, but we have plans to add units to it and it will probably exceed 1,000,000 kilowatts after 1960.

FISHER: What are your largest generating units?

MALENKOV: This year our manufacturing industry will begin to make turbine-generator units of 200,000 kw.

FISHER: What is the design?

MALENKOV: They are standard, more or less. You would recognize them. They will operate at 180 atmospheres (2700 psi) and temperatures of 570 C (1060 F).

FISHER: I have been told that you're planning an elaborate network to allow you to shift generated power almost to all parts of the Soviet Union. Will you describe it?

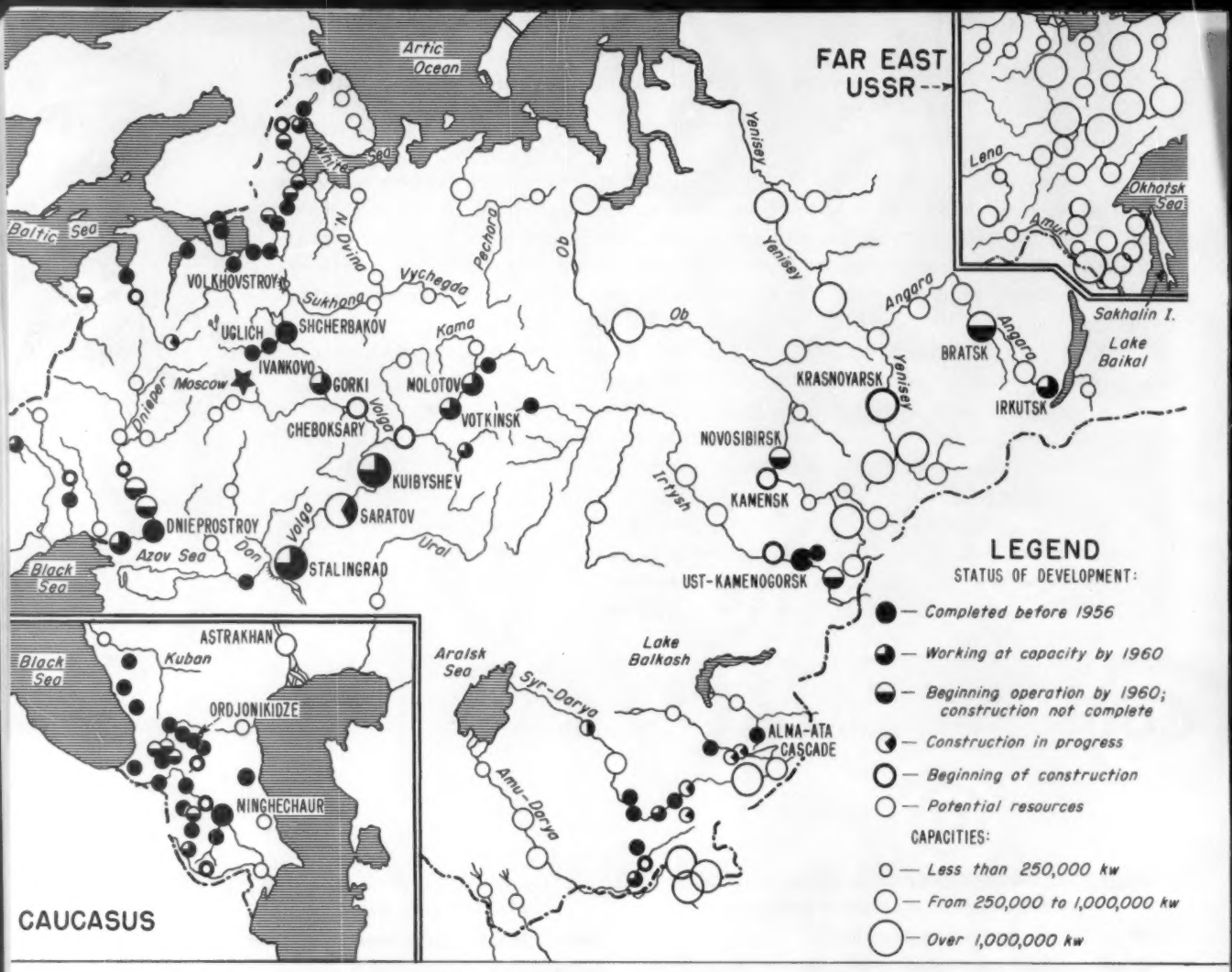
MALENKOV: Well, we have three main power centers. The Ukraine, the Urals, and what we call Central Europe— the Moscow district. The Volga hydro system, which you will see, is part of "Central Europe," so are many thermal plants. Already we have tied the Ukraine and Central Europe into a network. And we will continue in this direction, finally linking the Urals and even Siberia.

FISHER: What is your timetable? When will you do all this?

MALENKOV: By 1960 we expect to be able to link the power in the Urals with the Ukraine and with what we call the Central Europe network.

FISHER: At what voltage will you transmit?

MALENKOV: Up to 400 kv . . . and we will transmit 800-kv dc between the Stalingrad area and the Donbas network. You will see the Noginsk station, where 400-kv ac comes to Moscow from the Kuibyshev dam.



"We estimate only 2% of our hydro potential has been developed"

FISHER: I take it your plans to increase your power-generating facilities behind the Urals and in Siberia are for the purpose of furnishing more power to what you call the Central Europe network.

MALENKOV: That is correct. And furthermore the 2-hour difference in time between the Urals and Moscow makes it possible for us to build relatively smaller capacity plants. We can shift power from east to west, as the sun moves and the demand changes. This will allow us to save about 500,000 kw that we would otherwise have to provide.

FISHER: Are your plans for Siberia entirely hydro?

MALENKOV: No, in Siberia we are building both thermal and hydro because we need much power there to enable us to solve the economic problems of those areas. Also, we are going to need more power in the Urals, and Siberia is the best place to get it. By 1960 we expect to have 30 billion kwhr generated in Siberia and available for use in the Urals.

FISHER: In the United States about 50% of the maximum practical hydro power has already been developed. Our further expansion will be predominantly steam. What is the comparable situation in the U.S.S.R.?

MALENKOV: In this respect we have an advantage over the United States. We estimate only 2% of our hydro potential has been developed. So far we have built only in the flats—along the Volga and the Dnieper, in central Russia. We are now starting in Siberia, where the "efficiency" of our plants will be twice that of those in the flats because of the high head of water and the size of the river.

FISHER: Can you give me an example of this?

MALENKOV: Yes, the Irkutsk station on the Angara in Siberia is rated at 650,000-kw capacity, the same capacity as Dnieprostroy. But Irkutsk has twice the output because of the difference in the rivers.

FISHER: What is the largest hydro unit you now plan?

MALENKOV: I will give you a piece of news. We are just starting construction on the Bratsk dam, which you have probably heard about. It has been published that Bratsk will be 3,200,000 kw. But, when finished, it will actually be 3,600,000 kw. You can print that.

FISHER: When will Bratsk be finished?

MALENKOV: In this 5-year plan, by 1960.

FISHER: Your biggest dam now is Kuibyshev, which is 2,100,000 kw. You are telling me that Bratsk will be more than 1½ times that size. Is that correct?

MALENKOV: Yes, but Bratsk will have easily twice the output of Kuibyshev, again because of the steady flow.

FISHER: Kuibyshev is not your biggest hydro station now, is it? Isn't Stalingrad bigger?

MALENKOV: Yes, Stalingrad is 2,300 mw, Kuibishev is 2,100 mw. You still measure in "kilowatts" though?

FISHER: "Megawatts" is being used more and more by us because of the bigger capacities. What is your estimate for total hydro possible in the U.S.S.R.?

MALENKOV: About 1,700 billion kwhr.

FISHER: And you're developing how much now?

MALENKOV: Only 28 billion kwhr.

FISHER: Suppose promising new forms of generating power, nuclear energy for example, come along. Will you still go ahead with your hydro program?

MALENKOV: In all circumstances the hydro will be done.

FISHER: In the United States we often allocate the cost of hydro installations three ways. To power, irrigation, and flood control. Do you have a similar accounting in the U.S.S.R.?

MALENKOV: Yes, but our third factor is not flood control as much as transportation.

FISHER: I suppose you mean the deepening and lengthening of your rivers, but transportation is only significant where there are people. Are there enough people in Siberia to make this worth while?

MALENKOV: People? You should come to Siberia and see.

FISHER: Is that an invitation?

MALENKOV: Yes, there are plenty of people in Siberia and next time we will take you there to see. You know one can more freely visit the Soviet Union now, than the U. S.

FISHER: How do you determine how much money is contributed to a dam by the ministries of power, agriculture, and transportation?

MALENKOV: Sometimes that is very difficult. The ministers will get together and argue, and it is not always easy to settle this. But the Power Ministry always pays the most.

(At this point I reached into my pocket and pulled out a 5-kopeck piece from the coin collection of a U. S. friend. It was dated 1763 and was larger than a silver dollar. I reached across the table and flipped it with my thumb as I did so.

I said to Malenkov, "This coin does not belong to me, but if it did I would give it to you to help settle these arguments." He laughed, reached for the kopeck, flipped it, passed it to Yermakov and Galotchkin, who then said, "This is of the time of Catherine the Second." I said, "Yes, we call her Catherine the Great." He replied, "I know you do.")

FISHER: I've heard of plans to increase the capacity of your present installations on the Volga by diverting the flow of other rivers into it. Can you comment?

MALENKOV: Yes, as I said before, the hydro possibilities of Central Europe are all but exhausted now, but I think our plan to increase them might interest you. Our new dam at Kuibyshev has an output of 11 billion kwhr. For the same cost of this dam we can turn parts of two rivers from the Arctic into the Volga and increase the hydro output of the Volga by approximately 11 billion kwhr. It gives us another Kuibyshev.

FISHER: What rivers would these be and are you really going ahead with that?

MALENKOV: These would be the Pechora and the Vychegda, and we are going ahead with it.

FISHER: About 88% of all United States generating capacity is located in central stations. This means that our industrial plants generate very little of their own power now. Is this also true of Russia?

MALENKOV: Yes, we, too, are centralizing our power, and this is our major possibility to win in the competition with the United States. At the moment about 73% of our power is in central stations, the remainder is located in industry and small towns.

FISHER: This 27% in industry and small towns — can you break that down?

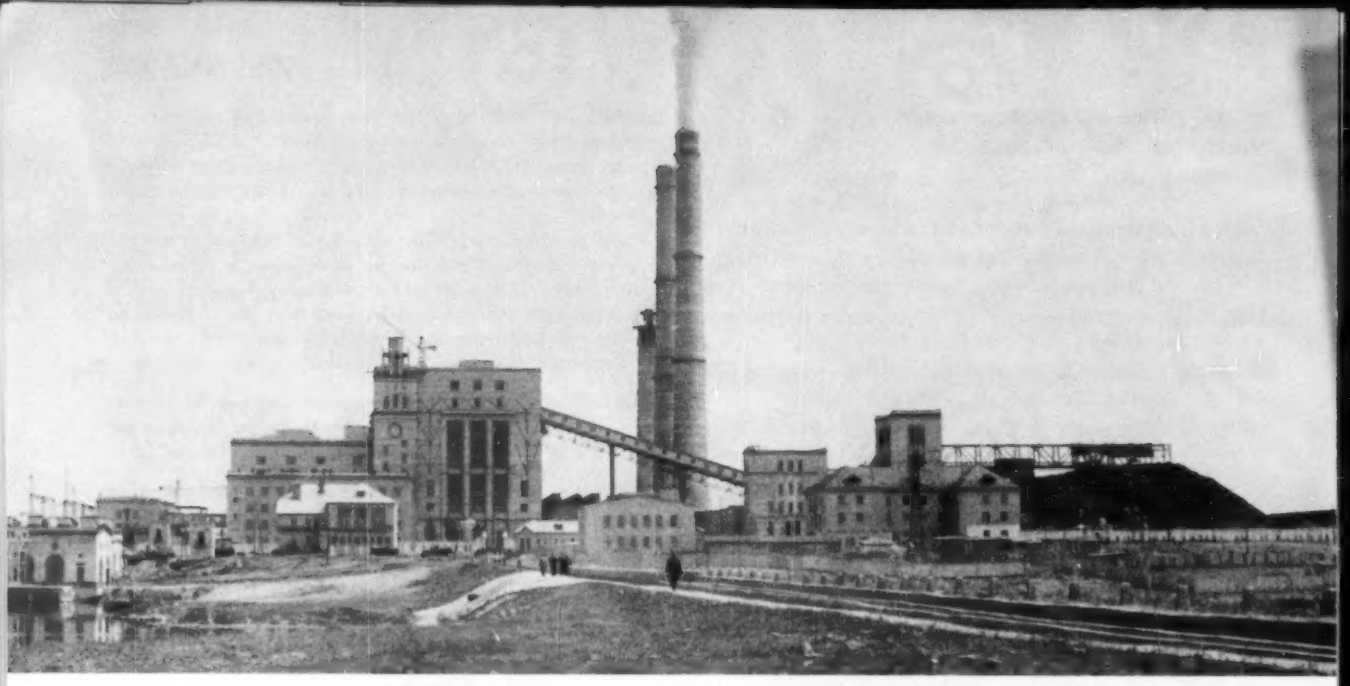
MALENKOV: About 22% is in industry and 5% is in small towns and in small stationary plants for agriculture. You call this "rural."

FISHER: In the last ten years the output of air conditioning equipment in the United States has increased by five times. Much of this is being installed in United

A 550-mile, 400-kv power line . . .

delivers output of 2100-mw Kuibyshev hydro plant to Moscow. Line's south circuit connects to a substation at Noginsk, north circuit to another in Moscow. A 48-mile tie links the two, forming part of the Moscow area ring system.

Alexei Uhartsev, operating engineer of Noginsk substation, studied six years at Moscow Power Institute, graduated 1955. During summers he learned "industrial practice," spent short periods in Leningrad and Moscow substations before being assigned to Noginsk. His salary is 1600 rubles a month — $400 at the official rate of exchange, but closer to $200 in purchasing power. He hopes his next job will be chief engineer of some other substation, says, "no faults have been found with me."



Cherepets plant (see p 85) has 300,000 kw in operation. Present and future additions will bring it to 1,000,000 kw capacity

"we can build a station of 1,200,000 kw for 25% less . . ."

States industry to improve a manufacturing process or to guarantee the uniformity of a product. Can you comment on your use of air conditioning?

MALENKOV: Have you felt the need of air conditioning in Moscow?

FISHER: No, but Moscow is not Russia, is it?

MALENKOV: You are right. I admit we have all sorts of climate and that we have not as much air conditioning as you. We do need it here and there. It is a very progressive thing.

FISHER: Undoubtedly, the mechanical power per worker has increased in Russia in recent years. Can you give me any statistics on this?

MALENKOV: We attach great importance to this. The problem of increasing the productivity of labor can only be solved if we can increase our output of electricity. I can tell you this, that we budget for all our ministries and the Ministry of Power continues to get the big share of our Soviet money.

FISHER: Can you give me figures on your increase in power per worker?

MALENKOV: Well, in 1937 we had 3,000 kwhr per worker available. In 1956 we have 8,400 kwhr per worker. So we have made some progress.

FISHER: You mentioned that your ministry is getting major financial allocation. Can you be specific?

MALENKOV: The present 5-year plan provides for an increase in the production of all of our industries of about 66%; but we are planning an increase in the production of electrical energy of 88%. So, in directing the national economy of our country, we are developing electricity in such a way that its increase surpasses all other branches. That is the plan of the Soviet government, and we are allocating our funds that way.

FISHER: Are you fairly confident that you will achieve these targets when you set them up?

MALENKOV: We know that we will have to achieve them if we are to catch up to and surpass the United States.

FISHER: Why does the Minister always say "pass" the United States? Why isn't it enough to catch up?

MALENKOV: Because competition is interesting and you are not satisfied to do less well than your ability. We know the United States likes competition. Well, we will see you at the Olympics.

FISHER: Back to your steam plans for a moment. Do you expect your trend will be to larger plants as well as higher pressures?

MALENKOV: Absolutely, because we have found that we can build a station of 1,200,000 kw for 25% less than we can build four stations of 300,000 kw. And we have now found we also save about 25% in time.

FISHER: In my country we have a saying "Time *is* money."

MALENKOV: That is very good — in the Soviet Union time is money, too.

Now I would like to comment on something. In the USSR we are perfectly willing to see positive things in others, and we are willing to admit our mistakes. When the United States made up its list of strategic goods and prohibited them from reaching the Soviet Union, it forced us to develop our own industries in all directions, especially in the area of power. We have done that now and so we don't believe the United States won anything by this policy. Moreover, you restrict technical books and information from us, and the whole thing is most unpleasant. It characterizes the United States in a negative sense. It is not clever to have such a policy in these new days, especially when this information is available to us in London, Paris and Zurich. All the same we buy it, you see? Per-

haps this is embarrassing to you and I am sorry, but if we are going to establish normal relations, these measures should not be.

FISHER: It would not be fair to the spirit of these talks if I failed to remind you, Mr Malenkov, that the first steps toward the restriction of news and information were not taken in the United States. I have said that at home, will want to say it again, and therefore should say it while still here in the Soviet Union. We didn't start it.

MALENKOV: I appreciate the fact that you talk plainly . . . my associates have already said the same thing concerning you. Many visitors to the USSR say one thing here, and another when they get back home. In this case I think it will not be so.

FISHER: As to the United States policy of restricting goods, why is not the Soviet Union content with this policy and willing to go on supplying itself, and other countries in its orbit, without competition from the West? You say you have now equipped yourself in all these directions, and this would seem to give you a franchise without competition. As a pure business matter it would seem you would not be pressing for a change in this United States policy. You know that I speak only as a businessman and not as a politician or a diplomat.

MALENKOV: These countries to which you refer, the USSR considers them free countries who make their own decisions. This includes the economic field and they are free to buy where they please. As far as competing with the United States for business, I don't think a change in the United States policy is near, so it would be premature for the Soviet Union to make detailed plans for competing with you now. But we will welcome and enjoy that competition when it comes. In many of these fields there is much to be done because the Soviet Union needs much power growth to raise living standards to those of the United States.

FISHER: You call these "new days," and that reminds me we have another expression in my country . . . 'Rome wasn't built in a day.' Neither was Moscow, Mr Malenkov. Or Washington.

Red letter day . . . 3 months long

In Moscow, during a long, relaxing lunch, the Russians asked, "How does this idea strike your head to come to the USSR and see for yourself what is good and bad?" I explained . . . as near as anyone can explain where an idea comes from . . . and then said I had a question, too. "Why did it take three months for you to answer POWER's first letter to Mr Malenkov? You had it in April, but did not reply until July 5."

After a short exchange with Yermakov, in Russian, Galotchkin replied, "You see, Mr Fisher, your letter comes to the Ministry with no warning. So we read it and say 'Who is this Mr Fisher?' It so happens Mr Yermakov has a copy of your magazine – yes, POWER – in his desk, so we look for your name. But there is no Mr Fisher."

I broke in, "But that copy of POWER must have been seven years old, 1949."

"We come finally to discover this," said Galotchkin, "so by the time we find a new copy and see who is Mr Fisher, the three months have gone by."

MALENKOV: I know this expression. Yes, we know.

FISHER: In Stalingrad about a month ago Mr Khrushchev said that today the United States is the richest country in the world. But that tomorrow the USSR will be. And that you will do it with fast development of atomic power. Can you comment?

MALENKOV: He was talking about all the areas we have discussed today. Not just atomic energy.

FISHER: But you do have an atomic-energy program for power generation?

MALENKOV: By 1960 we expect to be generating 2½ million kw from our nuclear plants.

FISHER: How many plants?

MALENKOV: There will be eight plants, their capacity will range from 300,000 to 600,000 kw. The first plant we will build will be only 200,000 kw.

FISHER: Will they all employ the same type of reactor?

MALENKOV: No, each one will have a different reactor.

FISHER: Eight different types of reactors?

MALENKOV: Yes, each will be different, maybe only slightly, but we will test these different types and then go ahead with the best one.

FISHER: This 2½ million kw will be expensive power.

MALENKOV: Oh, we admit the construction cost is high, but we're willing to spend extra because of the future.

FISHER: How much are you willing to spend now? Two, three, or four times as much as conventional units?

MALENKOV: Well, the cost is not even twice now, but we're willing to subsidize the program.

FISHER: Are you going to build these eight plants at accessible sites where study and testing can easily be carried on? Or are you going to locate them where coal and hydro potential does not now exist?

MALENKOV: You have guessed it. We will locate them where other fuel is not available. Although they are experimental, to pick the right type of reactor, they are serious generating plants. We regard this as a technically solved problem. We have technically sound decisions for all eight of these nuclear plants.

FISHER: You have a reactor already generating power here in Moscow. Are you satisfied with it?

MALENKOV: Near Moscow . . . oh, it is a very small thing.

FISHER: About 7,500 kw?

MALENKOV: No, no, only 5,000.

FISHER: It is not on my program . . .

MALENKOV: This is now under reconstruction for about two months, it is torn apart for these two months. In the next month it will be working again.

FISHER: Well, I certainly am looking forward to the trips that have been arranged for me. I want to thank you for your hospitality and for this conversation. And for Mr Galotchkin's trouble, meeting me at midnight at the airport.

MALENKOV: This is our privilege. You will come again for a longer time.

Malenkov had been making notes and drawings on folded yellow paper during our talk. One of these was a rough map of Russia, with his sketch of the projected power network. As I said goodbye, I asked for one of these doodles. He declined, saying, "I believe they would say it is a nervous man." I replied, " They are more of an indication that a big man can also be human." Malenkov answered, "But in this case there is no application, for I am not even a big man."

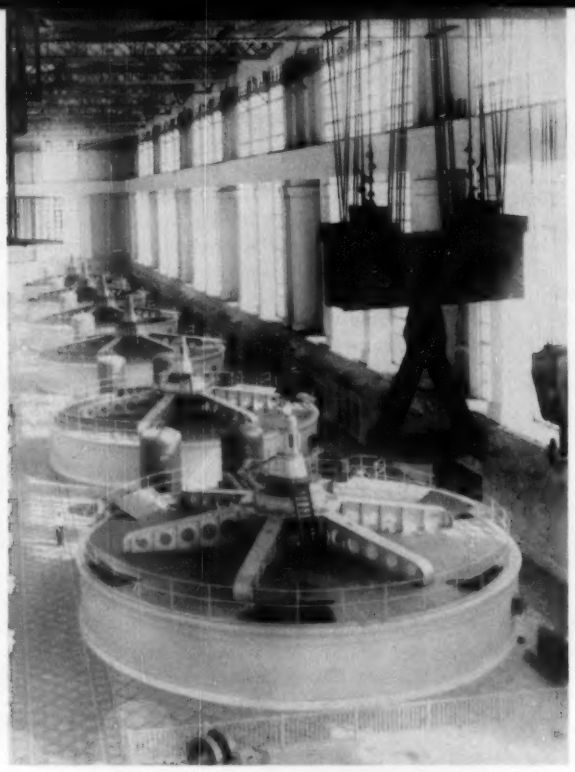
We ask our way at Perislav . . .

and at Yarislav . . .

and once more at Yarislav . . .

This is how you get there in Russia

The last stop for directions, at Rostov, brought some confusion: two people said to go right, one said left. So our driver said "We go with the majority," and turned right. Communism going soft?



Shcherbakov hydro plant has six kaplan units of 55,000 kw

"The Russians have made

Two weeks is a woefully short time in which to sample and appraise the power industry of a nation as large as the Soviet Union. But in addition to what I was able to see at first hand, I gleaned many interesting facts from conversations with Power Ministry officials and from internal technical and economic reports made available to me. On the way back home, I also talked with British engineers who had recently returned from an official visit to Russia.

What follows, then, is an attempt to sketch, in bold strokes, a picture of the USSR power situation today, with some comments on how it got there and where it is going.

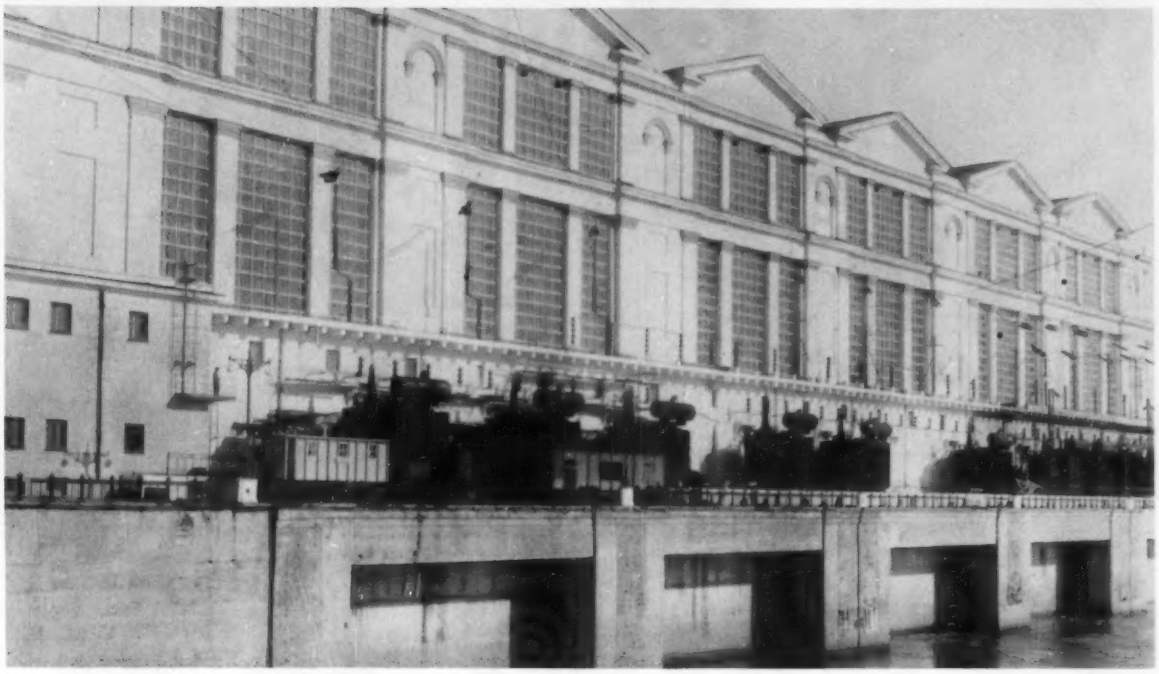
The Russians have made impressive power advances in spite of severe setbacks. In the last years of the Czarist regime, power output was about 2 billion kwhr annually. Part of this was lost in the Revolution, but by 1928 when the first 5-yr plan was begun, output had risen to 8.8 billion kwhr.

Concentration on heavy industry in successive 5-yr plans increased output nearly six times — to 48.3 billion kwhr, just before World War II. Then the German invasion took its toll: a loss of some 5-million-kw capacity, destroyed or damaged, equivalent to 19.2 billion kwhr annual output.

FOUR-FOLD GROWTH SINCE 1945

Reconstruction followed fast on the heels of the retreating armies, and by 1945, output was back to 43.3 billion kwhr, 86% of prewar. In 1955, output was 170.1 billion. This nearly four-fold increase exceeds our own fast *rate* of growth. Of the total USSR output, 72.7% comes from plants operated by the Ministry of Power. Their pride of accomplishment is easy to understand.

Stations built by the Ministry of Power take planned places in regional grid systems. As emphasized by Malenkov, the linking of these regional grids is being pushed (p 77).



On the Volga 250 miles northeast of Moscow, thirteen-year-old Shcherbakov had never been visited by an American

impressive power gains despite severe setbacks"

And a major part of future capacity additions will be hydro.

Unfortunately, I couldn't visit the newest dams, most of which are far from Moscow. They will have to wait for the return visit proposed by Malenkov in our interview. On the current trip, I had to be content with the much nearer Shcherbakov Station.

WE GO TO SHCHERBAKOV

Shcherbakov is on the Volga River, 250 miles northeast of Moscow. It was completed in 1943, but no American had ever seen it before. Neither had the three Russians who accompanied me. Now, a 250-mile trip from Moscow is the equivalent of going to Richmond, Va. from New York, to Detroit from Chicago, or to Hoover Dam from Los Angeles. But it was an all-day 10-hr ride, one way. We never stopped for gas, I saw not one filling station. There was no food, no drink en route. We lost our way, inside the four cities on the route, more times than I can count (pictures left).

You can only describe this kind of travel for Americans by stating such facts. Remember, this is not 250 miles into the wilds of Siberia; this is 250 miles from Russia's New York, or Washington. There are no highway numbers. No signs pointing to the next town. The paving disappears after 150 miles and the surface becomes rock, pulled from the nearby fields and joined together by dirt and sand. I saw battalions of women engaged in this work, sweeping the sand with brooms made of twigs.

This is the astonishing paradox of Russia. Possessor of the H bomb, the most modern jet planes, technically sound power plants, there is still much in Russia that is plainly primitive. To some extent, top Soviet officials seem to realize this. One said to me, "We know what to do, and how to do it, but we cannot do everything at once. It is like the roads. One-quarter is still bad." An admission, but in my view the arithmetic of that sentence is terribly inaccurate.

During the 1930's, hundreds of U. S. engineers went to the Soviet Union to help construct the early hydro stations. Rightly or wrongly, you are conscious of this influence today at Shcherbakov. It is much like any U. S. hydro plant of its size — 330,000 kw. In England, I was later told the same is true of famous Dnieprostroy, which the Germans nearly destroyed during World War II.

At Shcherbakov, I was told the total work force is 120 people — 40 for maintenance and 80 for operation. On the shift I inspected, there were six women, including the chief electrician. All the equipment I saw — and no part of the plant was denied to me — appeared to be of Soviet manufacture, except for two impedance relay protectors on 220-kv lines going to Moscow. They were marked "Westinghouse Type HZ."

SOVIET MORALE BUILDING

Even in the generator room of a plant far from Moscow, you don't escape the slogans which seem to be a necessary part of selling Communism. This huge sign was overhead.

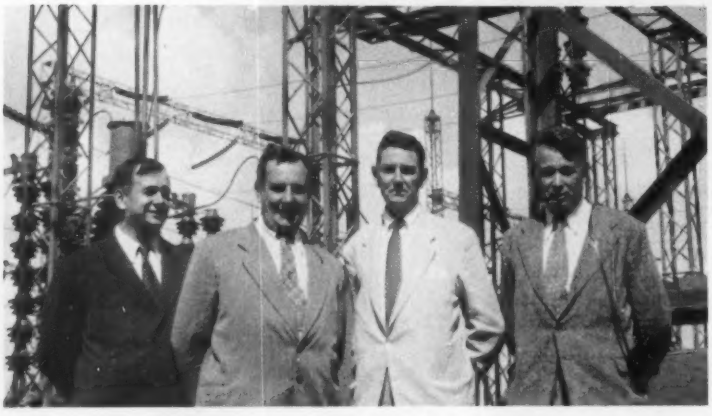
THE FULFILLMENT OF THE SIXTH 5-YEAR PLAN WILL BE A NEW LARGE STEP FORWARD IN THE DEVELOPMENT OF THE SOCIALIST ECONOMY IN THE PRODUCING OF LARGE QUANTITIES OF CONSUMER GOODS AND IN THE CONSTRUCTION OF THE COMMUNIST SOCIETY IN OUR COUNTRY

The only signs along the highways, incidentally, are placards, about 3 ft x 6 ft, each emphasizing one part of the current 5-yr plan: tractor production, bushels of wheat, barrels of oil, etc.

Shcherbakov is a clean station, with all the appearance of excellent maintenance. Here, as elsewhere, I felt someone had just gone ahead of me with a broom, but, in fairness, that is not unnatural for any guest, anywhere. Still there is

Boris P Lebedev, Chief of Technical Section, Power Ministry, and Nicholai Kondakov, chief engineer at Shcherbakov

Pretty welder on job at Cherepets



V A Kriganovsky, chief of operations at Cherepets; N W Twitchin, in charge of construction; Shelton Fisher; and Nicholai Golotchkin of the Ministry

Nina Chernova, Cherepets' chief chemist

Soviet power people, ranging from top Ministry executives to workers, have one thing in common, they are parts of a key industry. As such they enjoy special benefits like a 50% pension at age 55, paid even if they continue to work. There are incentive programs, bonuses for safety, efficiency. But, compared to U.S., real wages are still very low.

"Part of a plan for development of four great Siberian rivers"

a drabness to most Soviet installations, partly from bad lighting and partly from lack of paint and color. You wonder if attention to such details might not do more to lift morale than a dozen signs could possibly achieve.

The technical features of Shcherbakov can be summed up quickly. The earthen gravity dam is approximately 100 ft high with a crest length of 1710 ft. Maximum static head on the six kaplan wheels is 60 ft. Generators run at 62.5 rpm, are rated 68.75 mva at 0.8 pf and 13.8 kv.

Shcherbakov is part of the Volga "cascade," a series of dams totalling some 5000 mw, including the new plants at Kuibyshev and Stalingrad mentioned by Malenkov (p 79). Located where two rivers — the Mologa and the Schiksha — join the Volga, Shcherbakov acts as a regulating plant in the spring peak period and the summer. In winter it acts as a base-load plant while emptying the 1740-sq-mile reservoir to get ready for snow runoff.

All these plants can be seen on the outline map, p 78. This also shows the Bratsk plant, proudly cited by Malenkov as Russia's largest when completed in 1963. It is part of a plan for development of four great Siberian rivers: The Yenisey, 2650 miles long; the Ob, 2250 miles; the Angara, 1115 miles and the Irtysh, 1844 miles. The Yenisey and Ob flow into the Arctic Ocean, the Angara is a tributary of the Yenisey and the Irtysh of the Ob.

HYDRO DEVELOPMENT PLANS

Of the stations planned for these rivers, Ust-Kamenogorsk on the Irtysh is operating. Irkutsk station on the Angara, and Novosibirsk on the Ob are under construction and will begin operation before 1960. Work has begun at Krasnoyarsk on the Yenisey and Bratsk on the Angara.

Bratsk station is the largest of a cascade of six stations planned on the Angara, which flows out of 13,500-sq-mile Lake Baikal into the Yenisey. Total capacity of the six plants will be 10 million kw, with a yearly output of about 70 billion kwhr.

According to Malenkov, total capacity of Bratsk will

Prefabricated construction is much used in building USSR steam plants. In photo above, workers, including women, apply refractory lock to a boiler wall at an angle of about 20 degrees to the horizontal. Finished wall will be hoisted into position by the 64-ton crane, *right*. Soviets say about 90% of boiler fabrication is done "on ground."

be 3600 mw instead of the 3200 mw (16 units of 200,000 kw each) cited in Russian publications. Its yearly output of 22 billion kwhr roughly equals the combined production of the two largest Volga plants, Kuibyshev and Stalingrad.

The Russians began work on Bratsk early in 1955. They say it will take six years to complete the structural work, hope to have the first four generators operating at the end of 1960. All work should be finished by 1963.

This plant, of which the Soviets are justly proud, is at the Padun constriction of the Angara River, about 19 miles below the city of Bratsk, and about 435 miles from the outflow of that river at Lake Baikal. The dam will form a virtual inland sea, up to 15 miles wide and some 340 miles long. Experts of the Hydropower Project Institute in Moscow figure it will hold 233 billion cu yd of water.

"TURNING" ARCTIC RIVERS

In our interview, Malenkov also made a point of Soviet plans for "turning" two rivers that now flow into the Arctic Ocean. Diverting part of their flow to the Volga would, he said, increase output of that system by 11 billion kwhr, equal to another Kuibyshev station. The rivers involved, are the Pechora and Vychegda, a tributary of the Dvina.

I gathered that thinking along these lines began before World War II, although today's plans differ in detail.

As the map on p 78 indicates, the Pechora and Vychegda rivers have points close to the upper Kama, a Volga tributary. By damming the Pechora and Vychegda, and linking them to the Kama, some 52 billion cu yd could be added to the annual flow of the Volga system. The Russians plan to utilize this by building a new 600,000 kw station on the upper Kama, and by adding generating units at some of the existing Volga stations. They are also considering diverting into the Volga system, at another point, part of the flow of the Sukhona River, another Dvina tributary.

HIGHER STEAM CONDITIONS

In steam power, trends in the USSR have been generally similar to those in the U. S. But the Russians haven't gone quite as far as we have in most areas. Before World War II capacity of largest Soviet steam plants was in the range of 200,000 to 250,000 kw. It is now 800,000 kw and, as you will see later, the Soviets have plans for 1,200,000-kw "super" stations. Largest turbine-generator units now operating are 150,000 kw, with 200,000-kw designs under way. At the end of 1955, the Soviets say, there were 33 turbine-generators of 100,000 kw and two of 150,000 kw in operation on the power system of the Ministry of Power.

In Russia, as in the U. S., pressures and temperatures have climbed steadily. The Soviets define "high pressure" plants as those operating at or above 1500 psi and 950 F. Their statistics show slightly more than half of all plants operating above these levels at the end of 1955, and more than 90% of Ministry of Power stations.

WE VISIT CHEREPETS STATION

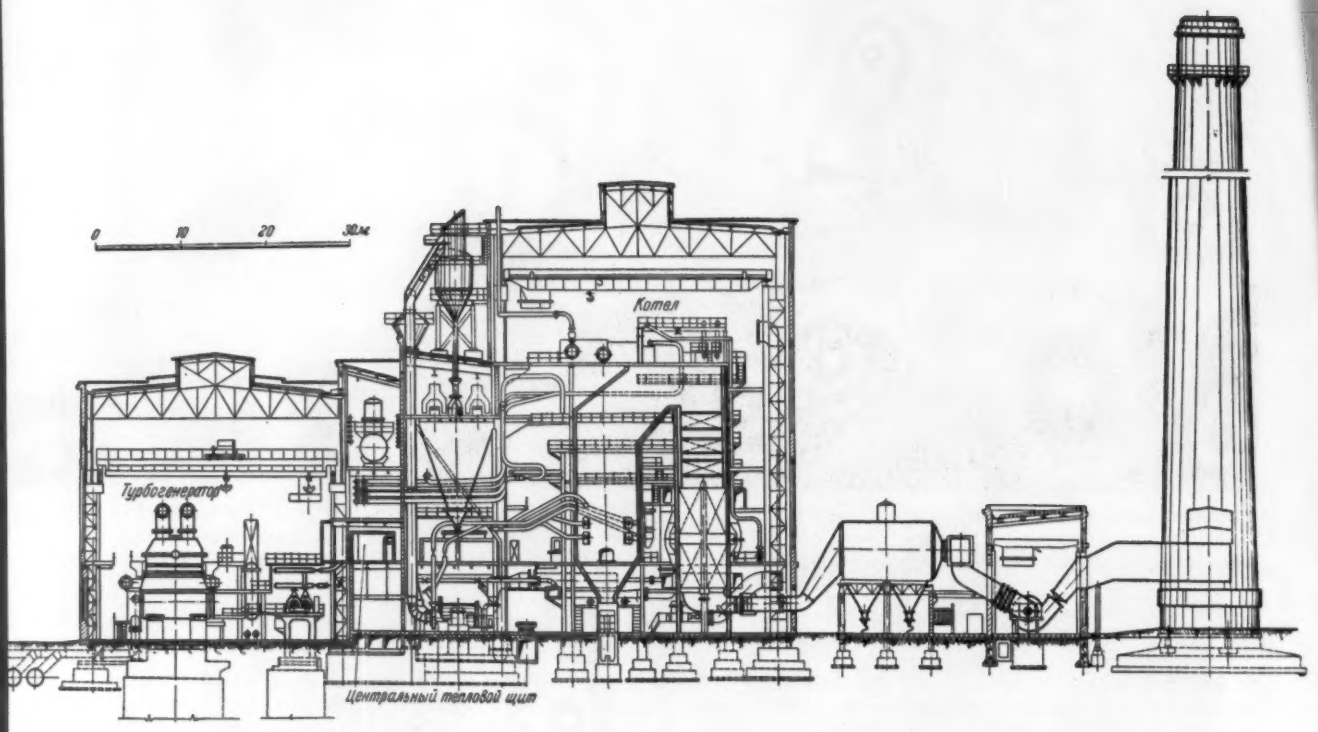
Typical of the steam stations building today in the USSR is Cherepets. It was begun in 1953; Malenkov says it will reach 1,000,000 kw by 1960. It now has two units of 150,000 kw, and one of the same size is under contruction. The plant, on the banks of the small Cherepets River, sits squarely on top of the Tula coal deposit.

The whole development at Cherepets, I found, is a planned community, from the ground up. Housing has been built for miners on one side of the river, for power-plant personnel on the other. There is a new cement plant, new rail lines, and a crude road leading some 20 miles from the main highway.

When I lingered too long at the plant, delaying dinner, Galotchkin said, "Mr Fisher, these fellows will talk you into the night. They live here. But you and I are separated from where we are going (Moscow) by the road they have not yet built. Now let us go to the town they *have* built!"

There are two chief engineers at Cherepets: V A Kriganovsky is in charge of operations, N Y Twitchin is responsible for all construction. They joked about the division of responsibility, showed me the imaginary line on the plant grounds where operating authority stopped and construction responsibility began. Each had a speech ready for me, both were proud of their achievements.

Kriganovsky said the Cherepets station, at the outset, had two targets: (1) To install and operate "super" high-pressure equipment (up to 2700 psi and 1030 F) and get 150,000 kw from the turbine-generators. (2) To accomplish



CROSS SECTION of Cherepets steam station, showing Russian lettering for boilers, turbines, drawing scale

"Cherepets has nearly all the trimmings of a modern steam plant"

this with low-grade coal giving 5000 Btu per lb, having an ash content up to 30%, and moisture ranging from 33 to 45%. Kriganovsky concluded with the statement, "All these problems are now solved."

PREFABRICATED CONSTRUCTION

Twitchin told me he was operating a construction force of 2000 people, of whom 400 were the erection crew for the power plant. The rest were building roads, canals, houses, and operating concrete plants, sawmills and garages for 200 trucks. He said they prefabricate "about 90% of a boiler" before erecting it with 64-ton cranes, adding the last 10% of fittings after the boiler is erected. (See pictures, preceding page). Twitchin stated that total erection time a boiler of Cherepets size is 80 days; that two years ago it was 110 days, and ten years ago it took six months.

I asked what Soviet engineers thought of outdoor steam plants and they said there were none except for a few in South Russia. At Cherepets last winter the temperature was —40 F for two weeks, the snow reached a depth of ten feet, and there were "big winds" much of the time. Looking out over the vast plains of Central Russia, you find cruel winters easy to imagine.

Cherepets has nearly all the trimmings of a modern steam plant. There are numerous automatic safety and control devices. For example, one heat indicator monitored 25 bearings, had a danger light and numerical indicator for the trouble point. The main steam inlet to the turbine was austenitic steel and they enumerated to me percentages of "nickel, manganese, chrome, molybdenum and wolfram (tungsten)." In the water-treating plant there was plastic piping, and the valves were hydraulically operated to give them a "power push" for this all-woman department.

Galotchkin said he was originally nominated to have charge of construction at Cherepets. But before it began, he was asked to move into the Ministry of Power as head of its foreign section. He indicated some regret, because the Soviets are openly proud of Cherepets. From what I saw, they have every right to be.

SOME DESIGN FEATURES

Cherepets is built on what the Russians call the "block" system (unit system to us). At Cherepets, a block consists of two 530,000-lb-per-hr boilers and one 150,000-kw turbine generator. The boilers are of standardized design, natural circulation, drum type, with radiant and convection superheaters. A reheat section raises steam temperature from about 650 F to 975. Both air heaters and economizers are tubular.

The brown coal is pulverized by two ball mills per boiler, which supply slotted, revolving burners. Combustion is controlled by an electronic system. Stack emission is controlled by electrostatic precipitators. Ash is removed by a low-pressure hydraulic system.

Steam reaches the single-shaft tandem-compound double-flow turbine at approximately 2550 psi and 1022 F. The turbines drive hydrogen-cooled generators rated at 167,000 kva, 0.9 pf, 50 cycles, 3000 rpm.

All this equipment is of Russian manufacture. The steam generating units are built at Taganrog in south Russia,

The Dogs of Moscow

It may be that the Russian sense of humor is as close to American as foreigners can get. Once my interpreter, Gleb Kosov, asked me to describe a martini. Afterwards, he said "Now I understand what I read one time. It said 'this martini is as dry as a cable from Moscow.' Yass, that is good."

After a week in Moscow I realized I had seen no dogs. Not one. So I asked Gleb about it and he said with a perfectly straight face, "Mr. Fisher, did no one tell you that it is the summer and all our dogs go to the seashore?"

Actually, the dogs are probably a casualty of (1) apartment living, there are almost no single family dwellings in the city (2) the fact that food, while not scarce now, is still not too abundant (3) pets, to some Russians at least, might not fit the spartan ideas of proletarian Communist living.

by "Krasny Kotelshchik," which may be translated as "Red Boiler Manufacturers." Turbines and generators are made in Leningrad, the former by the Leningrad Metal Factory and the latter by "Electrosila" (Electric Power) Factory.

The new unit being built at Cherepets is essentially similar to the first two "blocks," but will operate at slightly higher steam conditions: 2775 psi and 1075 F.

MOST USSR KWHR COME FROM COAL

Although the Soviets have big plans for hydro development, as Malenkov told me, the major part of their present production comes from thermal plants — nearly 83% in 1955. Most of these kwhr coming from thermal stations are made from coal — 66.1% of the total — but natural gas has shown slight increases. During 1955, however, it only amounted to 3.3%, along with peat at 7.9% and fuel oil at 5.3%. Most of the coal is what we would call low grade, yet the Soviets do very well with it. At some of their top stations, boiler efficiencies of 89 to 90.5% were registered on brown-coal units.

Soviet plans for the future envision larger units and larger plants. Earlier, I mentioned that the largest turbine-generators now in operation are 150,000 kw, but that larger machines are under way. During the next two or three years, Soviet factories will begin to build turbine generators of 200,000 to 300,000 kw. These will be designed, they tell me, for pressures of 3500 to 4400 psi and temperatures from 1110 to 1200 F. The Soviets expect to reduce fuel input by 10 to 25% through use of these higher steam conditions.

These larger units will be used in what the Russians term "super" stations of more than 1,000,000 kw capacity. In describing a plant of this kind, they speak of a first stage involving 150,000-kw turbine-generators, each supplied by two boilers, of about 575,000 lb per hr capacity each. The single-shaft, tandem-compound double-flow turbines have seven bleed points for feedwater heating. Throttle conditions are 2500 psi and 1075 F, approximately.

A typical superstation is described as having what appear to be once-through boilers, which, the Soviets say, have been found to provide greater safety in operation at high pressure than the drum-type boiler. The Soviets also point to cost advantages. Makeup for these superstations will be treated by a demineralizing system.

Except for some details, it can be seen that Cherepets, with the four 150,000-kw units it will have by 1957, or thereabouts, could be the first half of such a superstation. Since Malenkov spoke of Cherepets eventually reaching or exceeding 1,000,000 kw, I would be inclined to guess that its later development would follow that outlined for the typical superstation.

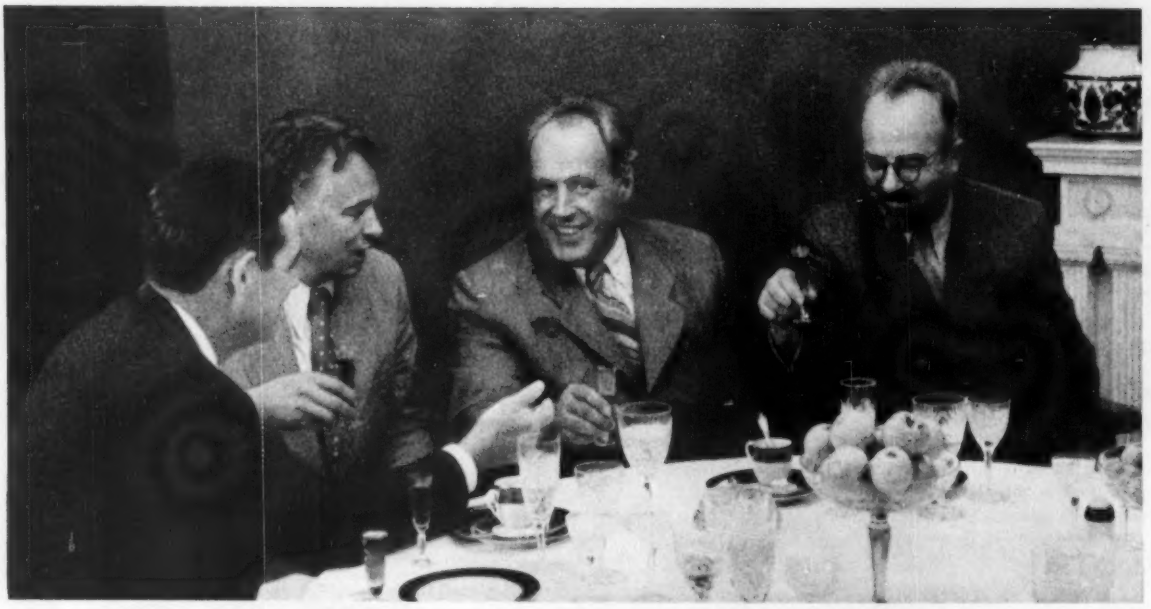
The second stage of superstation development foresees the use of a full unit system, with each 200,000-kw turbine-generator supplied by a single steam generator of more than 1,400,000 lb per hr capacity.

REAL GAINS FOR USSR

In the limited space available here, I could only tell of the things that struck me as most important or most interesting. There still remains much detailed information to be digested for later issues, perhaps.

This report of USSR power practices could only tell of the things that appear most important or most interesting. But it has been adequate, I believe, to support the earlier statements that the Soviets have made very real advances in the power field. This could mean, eventually, more output of consumer goods for the Russian people, as more power becomes available. In fact, there is enough power now if some of today's capacity was diverted to peacetime goods, and away from war production. Whenever that is done, whenever the Russian people begin to possess some of the good things of a peaceful life, it will surely do much to relieve the tensions generated by the lack of them.

COAL-HANDLING FACILITIES at Cherepets resembles American



LUNCHEON with Soviet technical-press officials at Moscow's Praga restaurant. *Left to right:* Shelton Fisher; Nicholai Galotchkin; S P Kashnikov, President of the Technical Publishing Division; Alexei Smirnov, Chief Editor

"...from interchange...there is much to be gained."

In several meetings with men from the Russian technical press there was good opportunity to examine the Soviet counterpart to POWER, even to compare their industrial publishing network to the wider structure of McGraw-Hill Publishing Company.

The publishing "company" of which S P Kashnikov is President seems to be an active source of technical literature. It publishes monthly magazines for the three ministries of Power Stations, Power Construction, and Electrical Manufacturing. In addition there are numerous pamphlets on steam and hydro practice, on specific power stations, on certain phases of the Siberian program, on the Central European network, etc. There is a new monthly publication on nuclear energy.

Almost all of the material given me is brand new. The printing dates for most of it were late June and early July of 1956. One item, a "fact book" of statistics for all Russia's industries, was published in May for the first time in twenty years of official silence.

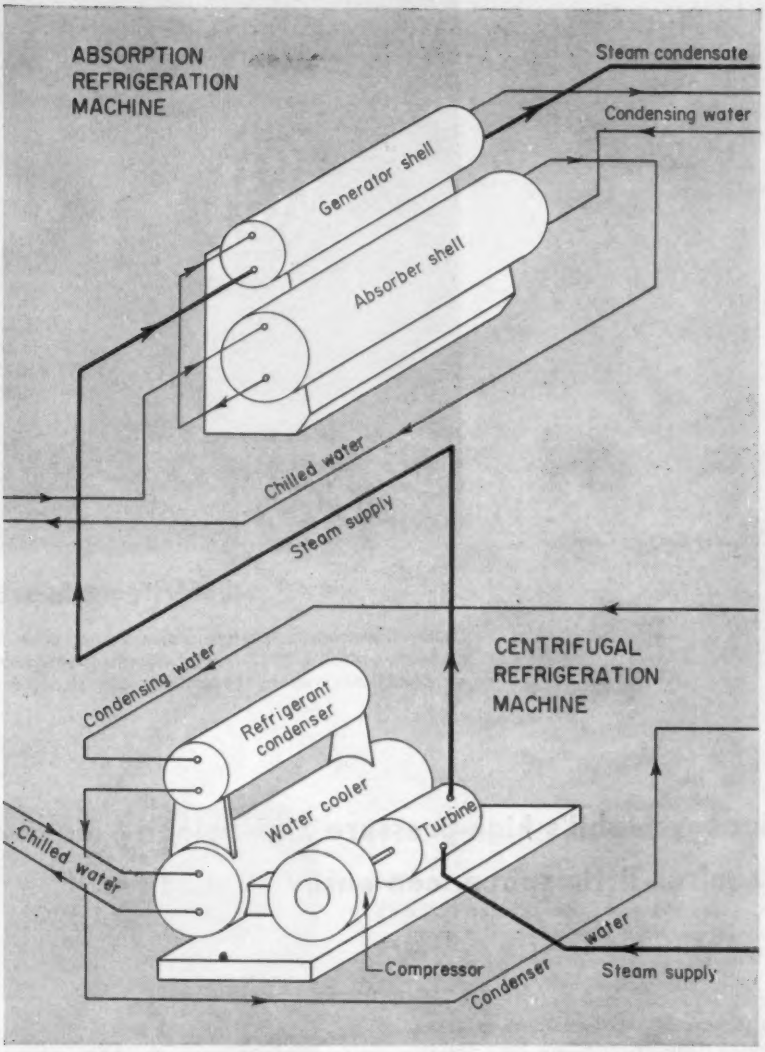
By U. S. standards, all of this material, while informative and reasonably clear, is dull and unappetizing in its presentation. It can be argued that this is unimportant to reading matter that is useful and instructive, because the technical reader will dig out what he needs, even if the digging is hard. But POWER's staff knows this is not necessarily so; or at least, that technical information, like any other, is better read by more people if it is skillfully presented and if care is taken to write well, to use "talking" photographs, and to make the whole context seem interesting, as well as useful.

In fact it is on that point that the whole Soviet system, as well as their technical press, might be snagged. In Russia, the element of *desire* isn't built into anything very much. There is almost no advertising or salesmanship, except of the idea of Communism. But there is quite a lot of advertising of that.

When they were shown copies of POWER's special reports and other U. S. technical data, in three and four-color printing, with photographs and drawings which were lavish by comparison, the Soviet editors were visibly impressed, were envious, and were frank to say so. They were also frank, and very persistent, in advocating a wider exchange of literature and of people with the U. S. This was the urging of almost everyone I met . . . from chief engineer Kondakov at his remote post on the Volga, to Malenkov in his office at the Ministry.

The Russians certainly seem to hope the new trickle of exchanges with Americans will steadily increase, and so do I. Providing it is an open street, with equal and free traffic on both sides, there is much to be gained and we might get the biggest share.

That is because of the likelihood that, over the long pull, more of the U. S. ideal of freedom and enterprise *will appeal to the Russians* than could possibly be the reverse.



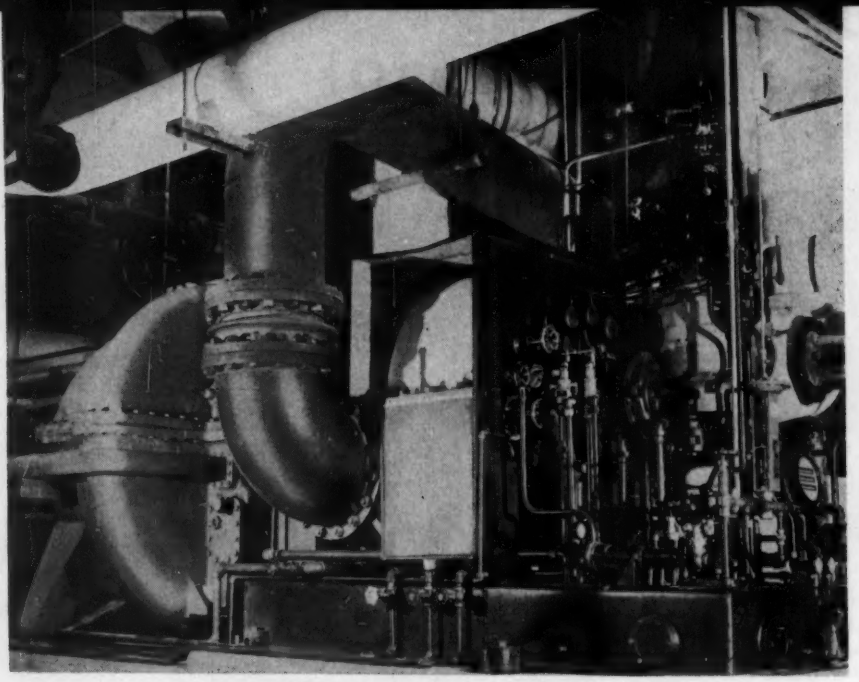
Teaming up absorption with centrifugal refrigeration is one big reason why . . .

The giant Socony Mobil building gets economical air conditioning

► THE WORLD'S NEWEST and biggest metal-clad building—The Socony Mobil Building—can also lay claim to several other important distinctions. Ranking high among them is a novel scheme for air conditioning.

Drawing, above, highlights some of the unique features. The building's refrigeration plant, split between a sub-basement machine room and a rooftop penthouse, includes one 500-ton and two 1000-ton centrifugal machines, plus three absorption machines with a total capacity of 1400 tons—3900 tons in all.

By teaming up absorption with centrifugal machines, Consulting Engi-



Courtesy Carrier Corp

Centrifugal in sub-basement

Equipped with extraction-type steam turbine drive, this 1000-ton centrifugal machine is part of Socony Mobil's 2500-ton sub-basement refrigeration plant that provides chilled water for air conditioning up to 14th floor. L-p steam from turbine is piped to absorption units

Socony Mobil's high-pressure high-velocity air distribution requires little space, can easily be modified

neers Jaros, Baum & Bolles were able to make substantial cutbacks in steam consumption. Here's how they did it:

One of the 1000-ton centrifugals—in sub-basement—gets its power from an extraction-type steam turbine. Exhaust at 20 psig is piped to the roof where it's cut back to 12 psig in a pressure-reducing station before entering absorption units.

All three centrifugals have steam drives, using steam supplied by The Consolidated Edison Co of N. Y. But exhaust steam from only one turbine is enough to supply the absorption machines.

Unlike other office buildings in which air-handling units themselves are spotted at many points, Socony Mobil's air-handling apparatus rooms are compactly confined to the rooftop and part of the eighth floor. In fact, the eighth-floor area is the only rentable space taken up by power-service equipment of any type.

Sub-basement refrigeration (centrifugal) supplies chilled water to all levels through the 14th floor. Rooftop part of the plant carries refrigeration load from the 14th to 42nd floors.

Air-handling units—filters, fans, cooling coils, heating and reheating coils—supply conditioned air to all office spaces through high-velocity conduit distribution networks.

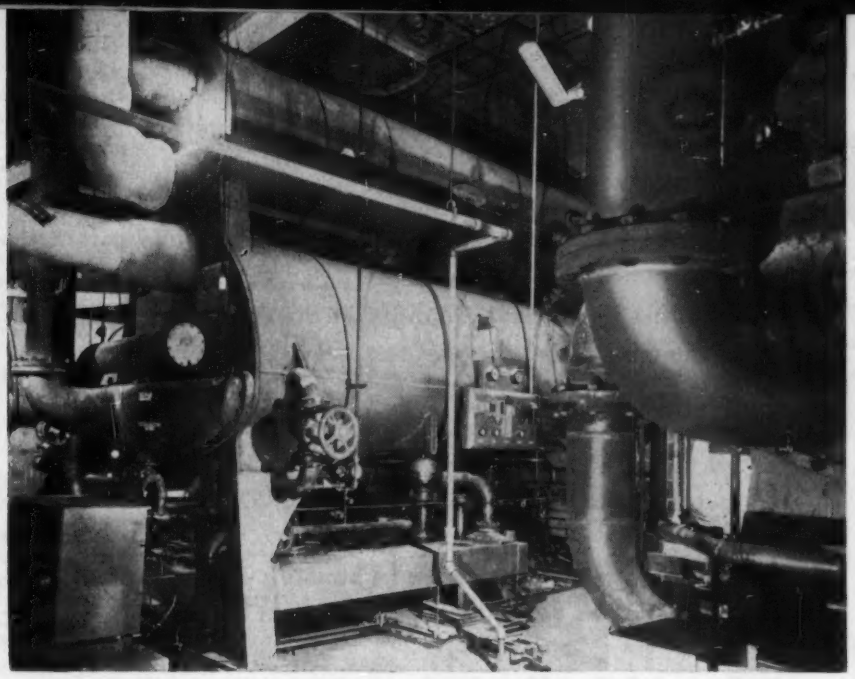
High-pressure high-velocity (4000-6000 fpm) nature of the air system makes it possible for Socony Mobil to concentrate air-handling equipment in only two areas, largely eliminating need for a main chilled-water riser. In structures using many air-handling units, such risers commonly run the entire height of the building.

Since about one-third of total refrigeration capacity is on the roof, directly alongside a 6-cell cooling tower, engineers also eliminated need for a separate condenser water line.

The extraction turbine that supplies steam to the absorption machines also feeds steam to reheat coils in the eighth-floor and penthouse air-handling rooms. Excess exhaust steam from tur-

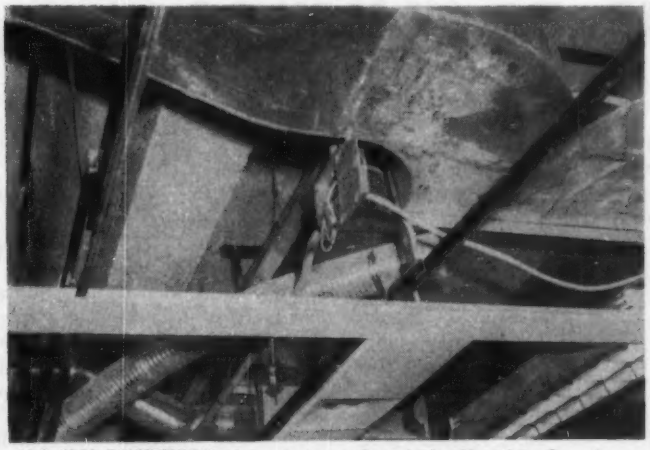
Why engineers favored this design . . .

- **Cost about 14% less than similar jobs of this size**
- **Saved several thousand sq ft of rentable space**
- **Centralized arrangement simplifies maintenance**
- **Double use of steam slashes operating costs**



Absorption in rooftop penthouse

Three absorption machines like this one (1400 tons total) use tap water as refrigerant, lithium bromide as absorbent. They're in Socony Mobil's rooftop penthouse. A pressure reducing valve drops steam from 20 to 12 psig required for operation of absorption units



H-P H-V DUCTWORK above hung ceiling looks like this. Sound attenuation box, flexible duct and diffuser are shown without ceiling.

bines is recovered as condensate that's used for cooling-tower makeup water. Also, hot condensate from the absorption machines passes through a heat exchanger where it preheats domestic hot water before going on to the cooling towers. Thus, Socony Mobil normally needs no city makeup water.

Two different systems deliver air through the building. Perimeter system covers exterior areas, inward to about 15 ft. Balance of area gets air from interior system. Cabinet-type air-control units—one to a window—serve perimeter rooms. They receive air through thin space-saving conduit-type ducts (4 to 12-in. diameter) that run vertically between pairs of windows. Engineers were able to use these ducts because, as we've seen, system is high-pressure high-velocity design.

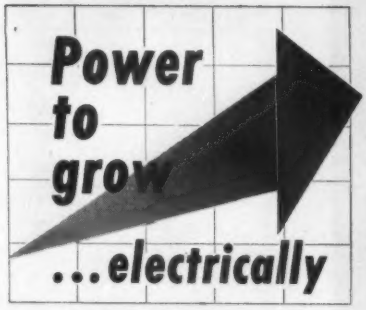
Exterior system. The cabinet-type air-control units form continuous finished enclosures that run from column to column and form window sills. They take 100% outside air, eliminating need for a return-air duct. *Primary* conditioned air enters the room through ejector nozzles in the cabinet, inducing a secondary (room) air flow to pass through the unit over chilled coils or, during the winter, over heated coils.

Water flow rate through these coils varies, depending on the heating or cooling loads in the rooms. Thus, room temperature stays within close limits. Zone control of water flow by series of floors, as well as by main directions of exposure, compensate for special conditions such as sunlight and shade. Locally adjustable thermostats, one to each bay, allow occupants to choose comfortable temperatures.

Interior system. A *dual-duct* system distributes air to interior areas. The arrangement consists of a pair of ducts —one containing cool, the other warm air—located in vertical shafts at the building's core. Automatically controlled mixing proportions cool, warm air to yield the right room temperatures. Main ducts on each floor get mixed air from cool, warm-air core ducts.

Lightweight branch ducts run from mains in a loop system. They carry air outward along the ceiling to control boxes at about the center of each bay. Basically, it's much like a high-pressure steam plant where a loop piping

(*Continued on page* 186)



No. 2: SYSTEM PLANNING

A design guide for your PTG system

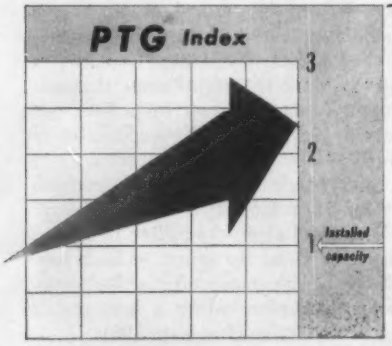
- **Provide space for expansion . . . in the primary sub, cable ducts, secondary subs. Don't design yourself into a corner!**
- **Keep a high IC safety margin in all key switchgear. This is one area where changes tomorrow will be costly**
- **Shoot for higher voltages. Think in terms of 4.16 and 13 kv for primary distribution, 480 volts for secondaries. In commercial buildings check utility for 480/277 supply**
- **Make a one-line diagram of ultimate system. Install only those portions needed to handle present load**
- **Set a definite PTG index for various segments of your system: Higher at primary sub, dropping off close to load**
- **Plan steps needed for future double or triple expansion**

PTG SYSTEM PLANNING: Design

► WHETHER you're modernizing or building new, you must start by making some broad decisions about electrical supply, distribution, utilization. How well you handle this early planning just about determines whether the electrical system will be adequate for present needs, and even more important, whether you'll be able to expand it economically in the future.

Unfortunately there is no standard electrical distribution system that can be adapted to all industrial or commercial buildings since no two plants have identical requirements. Hence, planning starts with an overall look at present loads, probable load growth, load characteristics. We define *system planning* as: the pinning down of specifics to successfully meet load needs—today and tomorrow. And, in any reasonable approach to system planning, matters of safety, reliability, first cost, simplicity, voltage regulation and maintenance must be considered. Power-to-grow planning can hardly be considered apart from the basic system plan. Rather it should be a part of each step in the early stages of plant planning.

Future loads are hard to figure. Best you can do during system planning is pin down value of present loads and make provision for probable future growth. The big common mistake still being made in industry is ignoring the possibility of load growth during the planning stage. Best bet is to avoid trying to guess what actual load growth will be. Instead make "paper" plans for what should be done if load doubles, triples, etc. Fortunately, a well-designed modern distribution scheme

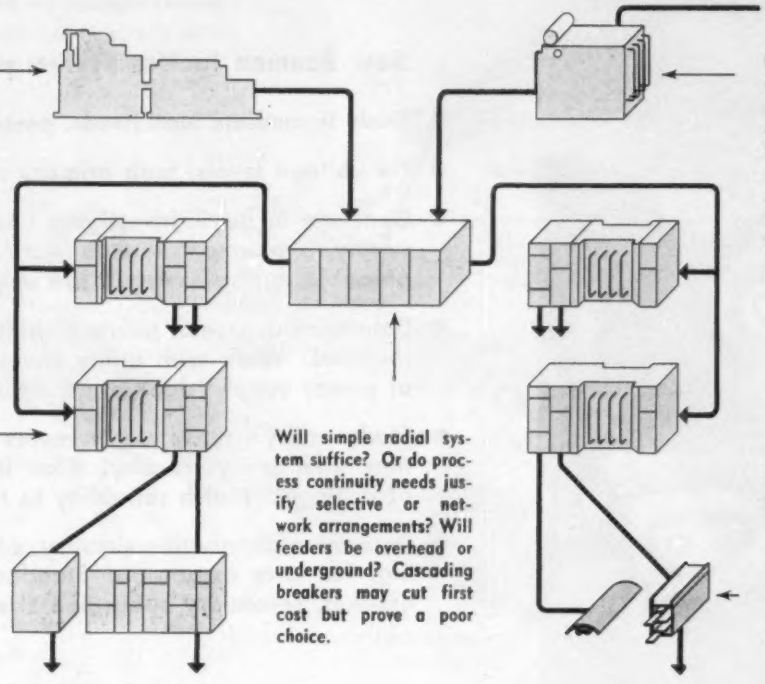


The PTG index: How big should it be?

By tagging the installed capacity as unity, the PTG index gives some measure of a system's expansibility. We define the power-to-grow area as the planned-for-capacity that can be economically provided and integrated into an existing system. And planned power-to-grow capacity divided by installed capacity is what we call the PTG index. It should serve as a practical guide for system planners.

The PTG index value, shown left, was selected simply to illustrate a point. Each article in this series will pin down the PTG practice in some particular plant. But when the cards are down, it's you alone who must decide the PTG index that is best suited for your plant. Knowing your industry will pay off here.

Check these points before planning any distribution system


Study possibilities for economical generation. Total-up plant-process heat-needs as a yardstick. Is low-cost or by-product fuel available? If generation is indicated, what size units now and in the future? How many to install?
Decide early on ownership and location of primary sub. Lower rate often goes with ownership but don't forget fixed charges, maintenance. Strive for several feeds from separate sources. What voltages are available?
Spot unit subs close to load areas, in low-value space. Will sealed dry transformers show long-term savings over vented dry-types or askarel? Add enough safety factor on breaker ratings to handle future loads. Specify spare breaker spaces in unit subs.
Will simple radial system suffice? Or do process continuity needs justify selective or network arrangements? Will feeders be overhead or underground? Cascading breakers may cut first cost but prove a poor choice.
Study control needs in light of speeds, torques, inrush, protection. Should controls be grouped in centers or spotted at each machine with bus-duct? Can you combine the power and lighting feeds? What about pf?

for tomorrow while installing for today

lends itself to economical growth.

If we had been writing this some years back we undoubtedly would have covered the subject of load-center distribution in detail; but that system is well recognized (POWER, Oct 1953, p 86) and widely used. However, matters of voltage selection, short-circuit protection and system relaying are growing in importance, especially from a PTG angle. These points were stressed in the PTG engineering conference held by POWER editors with some of the country's top electrical engineers (POWER, Sept 1956, p 80).

Voltage selection hinges on load size, distance, equipment ratings. Power men look with favor upon 4.16 and 13 kv for in-plant distribution. Greater safety of today's equipment, both in insulation and mechanical enclosure, makes high voltage nothing to fear.

Circuit-protection and system relaying are closely related. Real starting point here is getting to know what the available short-circuit current is. You get this from the utility company. Keep in mind that these values are subject to change as the power company beefs up its lines.

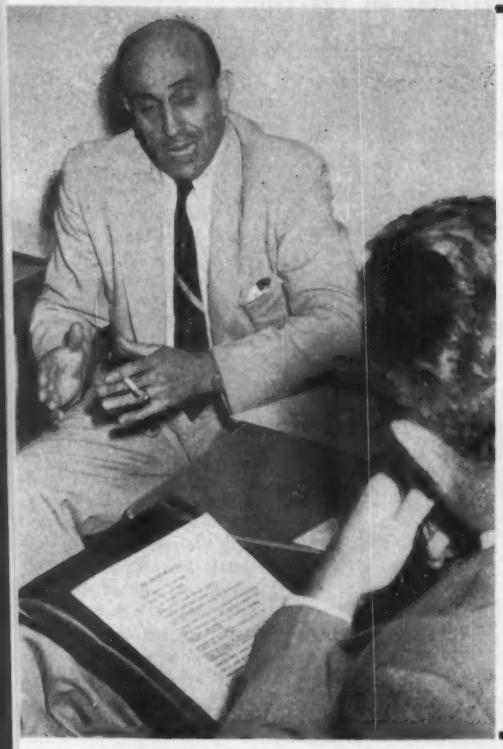
Space is often a limiting factor in a growing plant. So in your early planing allow room for additional substations, primary switchgear, generators, etc. Provide a good margin in spare ducts, troughs, conduits, so added feeders can be run through the plant without disturbing the existing structure.

Flexibility comes easily if a unit substation and bus-duct system are used. The unit subs can be readily added to or moved to accommodate changes in manufacturing processes. Cable troughs are another element contributing to flexible electrical distribution.

Keep in mind that while the electrical system is installed in parts, such as substations, cable, bus, switchgear, transformers, etc, the system nevertheless, functions as a unit. And the best single way to get an overall picture of the probable performance of an industrial power distribution system is to make a one-line diagram. Here, on a single sheet of paper you have the system in entirety. The one-line diagram gives the power man a reasonable idea of what service reliability will be and how the system components will finally fit together electrically.

Reference books and literature to keep handy during the system planning stage are (1) upcoming *Electric Power Distribution for Industrial Plants*, second edition to be published by the AIEE this Fall; (2) recent *Industrial Power Systems Handbook* by D Beeman, published by the McGraw-Hill Book Co; (3) *Today's Electrical Practice*, POWER, October 1953. Also, several of the leading electrical manufacturers have available films, booklets, catalog material outlining many suggestions for system planning in industrial plant and commercial building.

How American Cyanamid system-plans a new plant



Cyanamid's H Carl Bauman

How Bauman tackles system planning . . .

- **Study immediate load needs, possible load growth**
- **Fix voltage levels, both primary and secondary**
- **Generate or buy? Investigate adequacy of utility supply, maximum available short-circuit current probable during expected life of plant**
- **Determine degree of power stability and continuity required. Work with utility company on features of power supply: dual feeds, lightning protection**
- **Study utility's relay requirements for line protection, emergency transfer. Plan in-plant relaying accordingly. Match reliability to transmission line**
- **Determine distribution circuitry, plan routes, spacing, for later expansion. Standardize on feeder, breaker, secondary substation sizes**

American Cyanamid adopts PTG index of 3

► *Industrial development in Florida took another step forward with the announcement that American Cyanamid Company will build a plant near Pensacola (map, right) for producing a new acrylic textile fiber called* Creslan. *This is the first plant in Cyanamid's new Fibers Div. The Division will be by A R Loosli.*

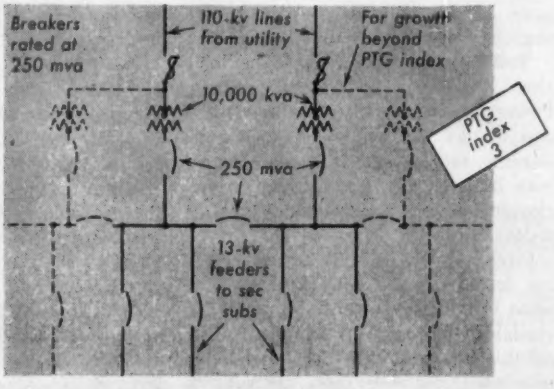
Cyanamid engineers will design, supervise construction of the plant which will employ about 350 people. Annual production is expected to be 27 million pounds of staple and tow with a 100% physical expansion potential built into the original plant design.

Although more than 20 essential factors were considered in choosing the plant site, two of the most important—excellent quality of water needed to process Creslan *and nearness of raw material sources—gave the Florida location top rating.*

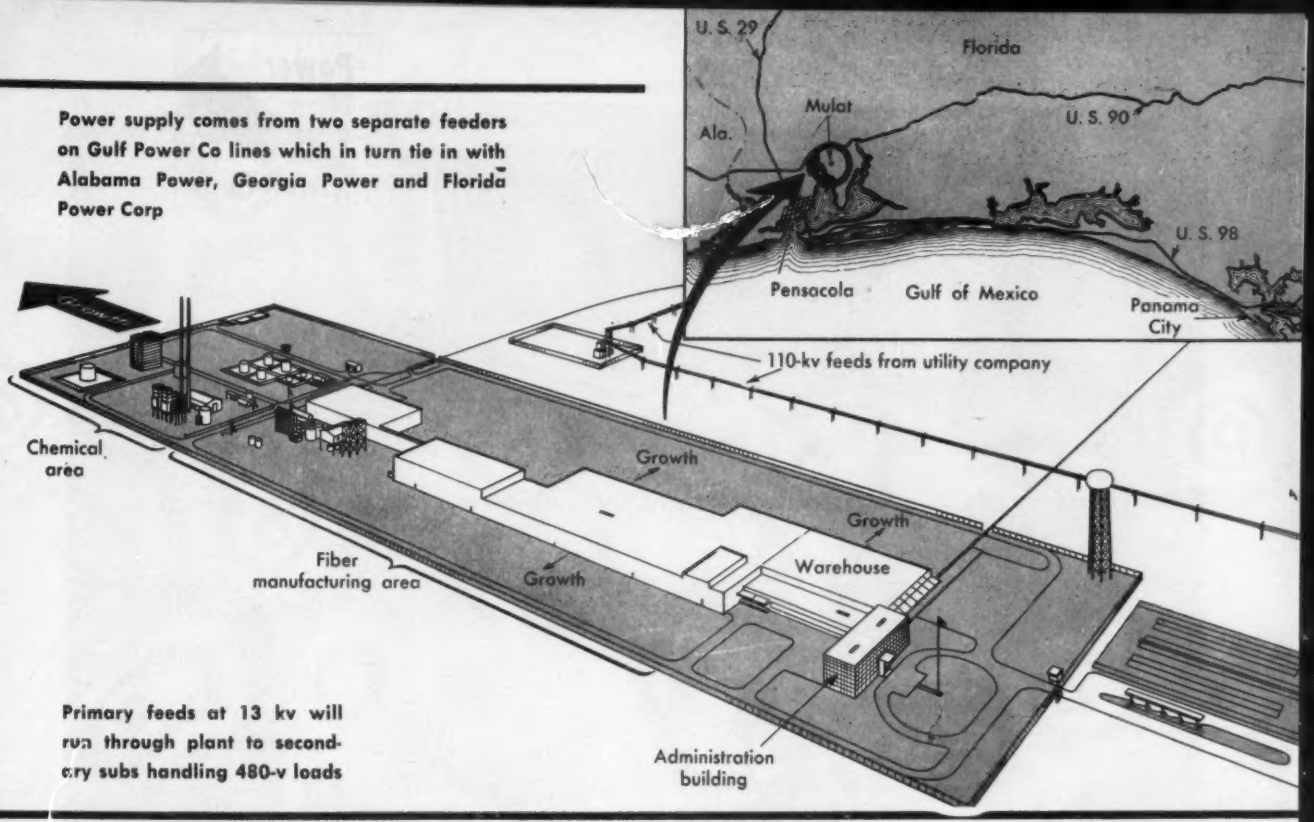
Above is the gist of a news release from American Cyanamid dated August 24. To most newspaper readers it signaled that another new plant would soon join the fast-growing chemical family. It also meant the day was not too distant when they could expect to find *Creslan* available.

But months before this announcement, plans were in the making at Cyanamid's engineering subsidiary, Chemical Construction Corp. Latter has recently been sold to Electric Bond &

With PTG index of 2 at secondary level, single subs can be changed easily for double-ended units



Primary sub's PTG index keyed to transformer size



NEW PENSACOLA PLANT, being built to produce Cyanamid's acrylic fiber *Creslan*, can double its size with ease

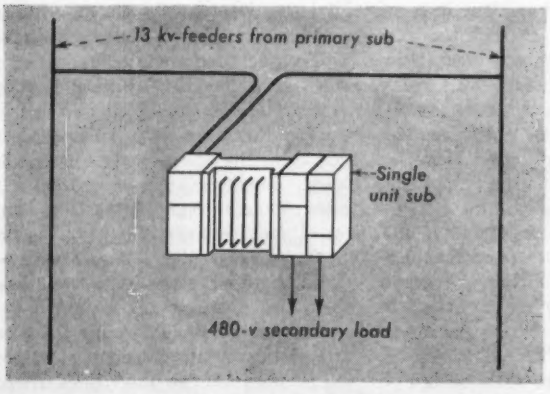
for primary equipment in new Florida plant

Share but continues to carry engineering responsibility for *Creslan* project.

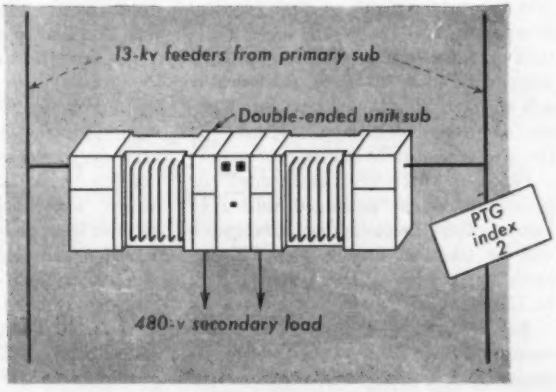
Coordinating the power-planning operation is H Carl Bauman, now Manager of Estimating, Cost Engineering for Cyanamid's Engineering and Construction Div. Bauman, an old hand at designing power systems for chemical plants, places a top priority on dependable electric power supply. In the making of *Creslan*, service continuity is measured in cycles, with a 30-cycle interruption the maximum that can be tolerated without a costly downtime item appearing on the production books.

With site selected, system planning for the electrical end started by analyzing load. When this new plant opens its doors in 1958, load will be 6400 kva at 0.8 pf. Load will be made up of some 530 motors, all induction with the exception of two synchronous 800-hp drives. Load factor is predicted to be 90% (650 hours normal monthly operation divided by 730 total hours in each month). Plans call for boosting the 0.8 pf to 0.95 with capacitors.

At this stage in the planning, it's hard for Cyanamid to see very far ahead load-wise. Although the plant will start operation in mid '58, it won't be in full production for about a year thereafter. But leaning heavily on his close working knowledge of the chemical industry, Bauman has selected a PTG index of 3 for the primary substation.



Secondary sub, hooked primary selective, can be . . .



connected secondary selective with double units

Turn page for more PTG ideas ▶

Power to gro... ...electrically

continued

'Study load needs . . .plan for growth . . . check power source . . .

. . . set voltage levels . . . select circuitry . . . then, sell it topside'

► What does a PTG index of 3 actually mean? Just this—the primary transformers are being installed to handle 20,000 kva which is about three times the initial design load. But, primary switchgear is being selected in light of the 6400-kva load with plans made for handling a load increase when it comes along *without need for a major electrical change or without interrupting production.*

Voltage levels are being set with PTG well in mind. Utility will supply power through two 110-kv feeders run into the primary sub so that physical damage to one line won't accidentally take out the other. Voltage will be stepped down to 13 kv in the primary sub through two 10,000-kva transformers connected delta-wye. Neutral on the wye side will be grounded.

Feeds at 13 kv will run through the plant, ending in packaged unit subs having 480-v secondaries. Exception will be feeds to motors over 200 hp, operating at 4160 v. Plant lighting will be 120/208 v.

Buy or generate? Because this is a chemical plant with a sizable process steam load, a study was made on the economics of electrical generation. But, in light of a favorable rate structure from the Gulf Power Co, in-plant electrical generation does not appear economical at this time. Steam in excess of plant process needs will power mechanical-drive turbines.

Power supply comes from two different feeders on the Gulf Power Co lines, which in turn tie-in with Alabama Power, Georgia Power, Florida Power Corp. Outages from lightning must be considered—and they are. Bauman is making a careful check on outage frequency traced to lightning, taking steps to hold it to a minimum. This means protection for exposed in-plant lines as well as utility feeders.

All feeders running overhead from the primary sub to plant's load areas will be equipped with lightning protectors. This single factor points up the need for matching in-plant system reliability with that of the supplying utility. Present plans call for a combinaton overhead and underground distribution scheme. Note from the one-line diagram, p 94, that entire plant load can be carried on one transformer if need be. Circuit breakers and associated relays will be geared to restore power within 30 cycles after outage of the preferred feeder from utility.

Relaying of primary substation equipment can follow several schemes. Here are the two plans getting serious consideration at present: (1) Both 110-kv lines normally feeding, with tie breaker on 13-kv main bus normally closed. Problem here is the possible power interchange through tie breaker since main feeders are supplied from different sources. (2) One feeder normally supplying power while other stands by. Tie breaker is normally closed. If the operating feeder trips out, a transfer arrangement closes in the "spare" feeder.

Interrupting capacity is a top-priority consideration. Either 250- or 500-mva breakers can be used in the primary switchgear. Should engineering study favor use of 250-mva breakers, reactors may be necessary at a later date to hold available short-circuit current in check. Breakers carrying a 500-mva rating would sidestep the possible later use of such reactors. Whatever the decision, plans are being made *now* for handling all problems that may arise when load grows in the future.

Secondary subs, following the now well-established load-center principle, will be fed from two 13-kv lines. Hook-up will follow a primary selective arrangement (POWER, Oct 1953, p 91).

Bauman outlines PTG plan for new plant to Cyanamid's General A C McAuliffe

Single-ended 500-, 750- or 1000-kva subs will be used for the initial load, with a swap made to double-ended units as load grows. Note from sketch, p 95, that change can be made without disturbing the primary system. A tie breaker on secondary then yields a secondary-selective system.

Plans call for standardizing on a minimum number of secondary feeder and breaker sizes; possibly 200, 400 and 600 amp. It will be most unusual to find a low-voltage circuit in this plant exceeding 500 mcm or a circuit breaker installed with a load rating greater than 600 amp.

Pf correction will be handled with capacitors. Here's a cost estimate:

Final pf	Annual savings, $	Capacitor costs, $
0.90	12,660	20,000
0.95	18,000	30,000
1.00	21,600	50,000

These figures point up a basic fact in correcting power factor: It seldom pays to shoot for unity. Here the best return on money invested comes when pf is corrected to 0.95.

Selling a PTG plan topside is the next step and a mighty important one. In too many companies this is the toughest part of the job. You may engineer an ample PTG index into a new or modernized plant but if you can't sell it to top management your planning will fall short of reality. For tips on selling a PTG program, review the kickoff PTG article (POWER, Sept 1956, p 75).

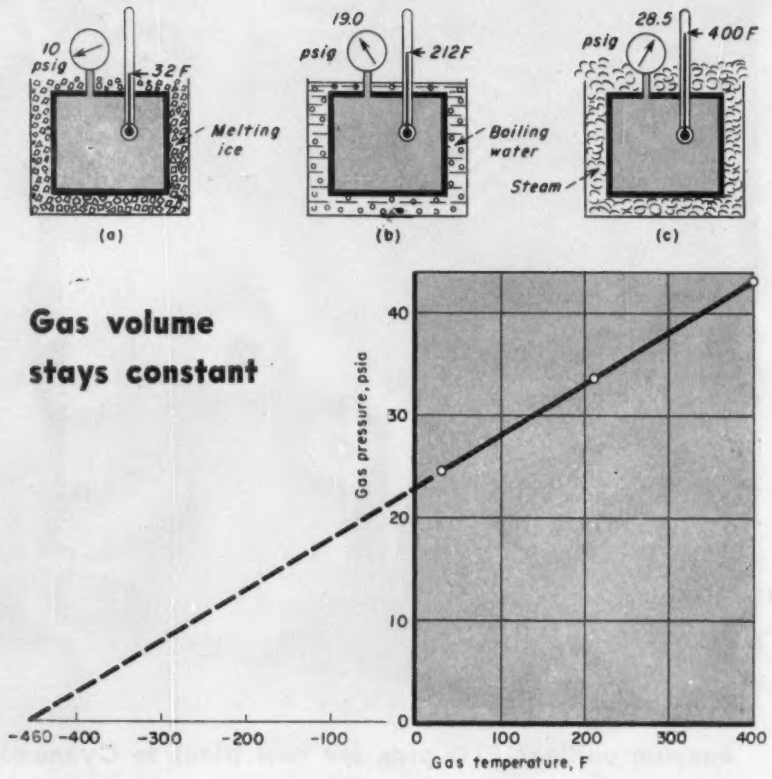
True, Bauman had to present sound engineering reasons for PTG spending before getting the green light. It meant thinking his system planning through and presenting the results to the head of Cyanamid's Engineering and Construction Div, General A C McAuliffe. But, after years of seeing their plants expand steadily, Cyanamid's management is accustomed to thinking in terms of growth and providing for it.

In this plant, as in most, the important ingredient in developing a sound PTG system is planning, early planning. Sure, a PTG system will always cost more than the "minimum" layout. But payoff for the relatively few extra dollars you invest today is bound to come tomorrow.

A quick look at the new acrylic fiber

Power men connected with industrial plants are primarily interested in the design, operation and maintenance of the power services. Yet, to do their job well, they must get to know the unique needs of the production equipment in their industry. Bauman has done just that over the years. And right now he is concerned with the power problems connected with making *Creslan*.

This new acrylic fiber has at least one requirement in common with many other materials in the chemical industry: it demands a reliable power supply with outages held to within 30 cycles. *Creslan* is the high-performance fiber that in a few years will be found in jersey fabrics, sweaters, sportswear, blankets, fur-like materials, plus certain industrial and non-woven fabrics.



1 Pressure exerted by a constant volume of gas varies directly with gas temperature. Gas pressure theoretically drops to zero at –460 F (zero internal energy)

Gases and vapors act as energy carriers, so we must learn how they behave when their temperature, pressure and volume change. We started on this last month, now let's continue the development and find out . . .

By B G A SKROTZKI
Associate Editor

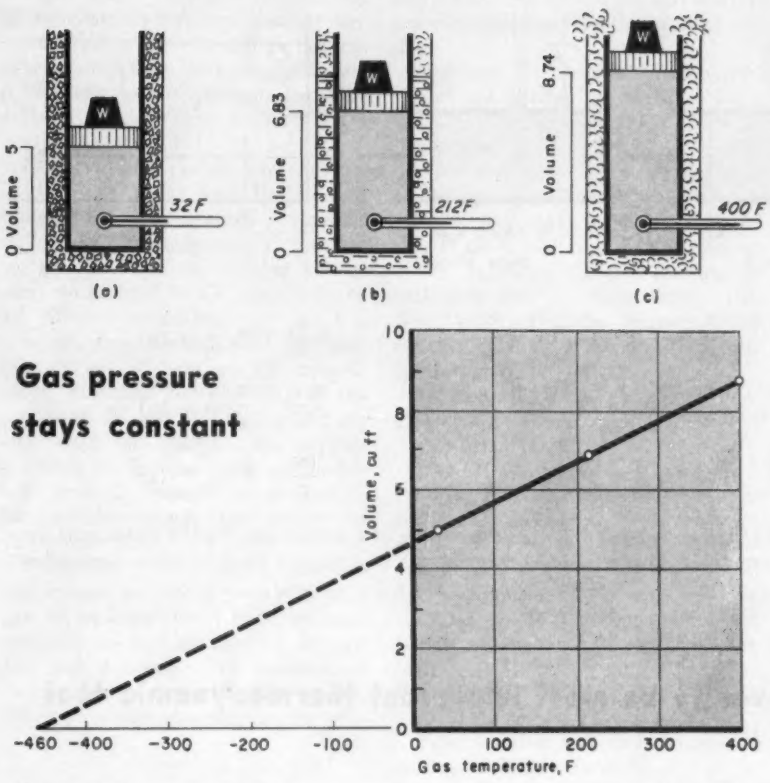
How to use the perfect gas equation

► WE FINISHED TALKING about Boyle's law in Part 2. This says that $PV = C$ for a given mass of gas when its temperature stays constant. But temperature changes rank as the most important factor in thermodynamic processes, so we must learn how they affect gas behavior. Effects of temperature were discovered independently by two scientists, Charles and Gay-Lussac, about the end of the 18th century. This was about 100 years after Boyle had discovered the $PV = C$ relation. We usually refer to the temperature relations as Charles' law.

Charles' law. To study the temperature effects, let's do some experimenting. In Fig. 1 we have a fixed weight of gas forced into a closed tank. A pressure gage and a thermometer allow us to take simultaneous readings of the gas pressure and temperature.

A mercury-in-glass thermometer, which we use here, is just an arbitrary indicator of temperature. Experience has shown that when a fixed mass of mercury or other fluid gets hot it expands; when it cools it contracts. By letting the expansion and contraction be magnified in a narrow capillary passage we have a sensitive temperature indicator that can be graduated as we find convenient.

With these instruments let's see what happens to the constant volume of gas in the tank. In Fig. 1*a* we cover the



2 Gas held under constant pressure varies its volume directly with changes in its temperature. Projection of curve shows its volume drops to about zero at –460 F

tank completely with melting ice and cool the gas to a uniform temperature of 32 F (Fahrenheit—an arbitrary temperature scale devised by a scientist of that name). We find that the gas pressure gage reads 10 psig. In Fig. 1*b* we submerge the tank in boiling water to bring the gas temperature to 212 F. Now the pressure gage shows 19.0 psig. Finally we douse the tank in a steam bath, Fig. 1*c*, raise the temperature to 400 F, and find that the pressure rises to 28.5 psig.

Next, let's convert the gage readings to absolute pressures:

Temp, F	*Psig*	*Psia*
32	10.0	+14.7 = 24.7
212	19.0	+14.7 = 33.7
400	28.5	+14.7 = 43.2

When we plot the absolute pressure against the corresponding temperature readings as in Fig. 1, we find the points lie on a straight line. This graph illustrates Charles' law: In a *constant* volume of gas the pressure varies directly with the temperature.

Absolute temperature. This simple straight-line relation of pressure and temperature suggests that there must be some temperature at which the pressure drops to zero. To find this we simply extrapolate the curve (dotted line) until it intersects the zero-pressure line. We find this intersection corresponds very closely to –460 F (more accurately –459.69 F).

Let's think for a moment what zero pressure must mean on the basis of the kinetic molecular theory. No pressure means no molecular impact against the wall confining the gas—hence the molecules must be completely stripped of their kinetic energy and they must be lying inert in the bottom of the tank.

But what does 0 F mean on the Fahrenheit scale? Nothing overly important. Fahrenheit *thought* that zero on his scale (mixture of salt and melting ice) was the lowest possible temperature; this was back in 1708. He took his oral temperature and labeled that 100 F on his thermometer; this worked out so that melting ice was 32 F and boiling water (at 14.7 psia) was 212 F. (Since healthy people have an oral temperature of 98.6 F—did Fahrenheit have a permanent fever?)

The graph in Fig. 1 shows that the bottom of the "true" temperature scale stands at –460 F. Here, theoretically, the molecules of a gas lay completely inert. In actual experiments –460 F has been approached within about 0.4 F. At this level, matter exhibits many quirks, for instance, liquid helium will not stay in the bottom of a container. It spreads itself out into as thin a layer as possible, climbing up walls of the container and down the outside, in defiance of gravity.

Since we are primarily interested in energy, and it appears that internal energy of a gas is zero at –460 F, Rankine proposed that this be taken as zero on an *absolute temperature scale*. To differentiate between Fahrenheit and absolute temperatures, the latter is measured in degrees Rankine, °R. Then at 32 F, the absolute temperature is 492°R; at 212F it is 672°R. In general, we can write:

$$°R = F + 460$$

This relation is shown on the adjacent scales of Fig. 4.

Pressure and temperature. From the straight-line relation of Charles' law, Fig. 1, we can write:

$$P = CT \text{ when } V = \text{constant}$$

where P is the absolute pressure of the gas, lb per sq ft, psf, T is the absolute temperature, °R, and C is a constant. This relation holds for any kind of gas, C being different for each.

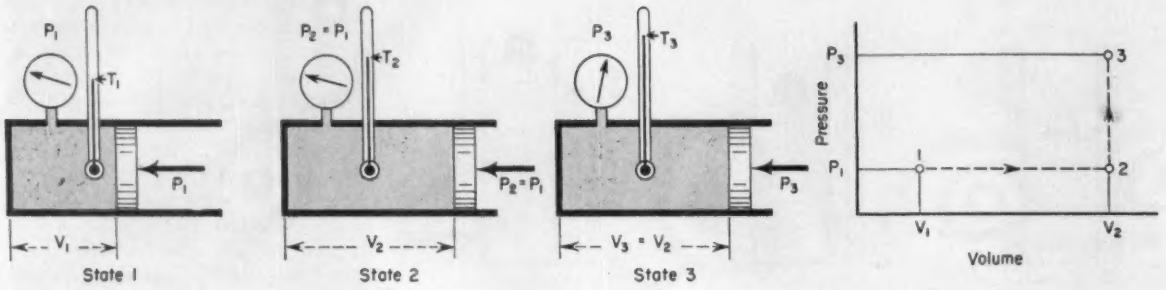
We can also write this part of Charles' law in the form:

$$\frac{P_1}{P_2} = \frac{T_1}{T_2}$$

The dotted line of Fig. 1 implies that the gas would stay in the form of a gas until it was cooled to 0°R. Actually, most gases would first condense to a liquid and then freeze to a solid long before temperature dropped to zero. But this doesn't invalidate our theory, because temperature reflects only molecular motion, that is molecular kinetic energy and not the intermolecular forces of attraction and repulsion that control the molecular potential energy. Potential energy comes into play during the change of phases from gas to liquid to solid, or the other way round.

Charles' law shows that as absolute temperature rises, molecular speeds increase. This increases the number of collisions per unit time between wall and gas molecules, which register as a rise in pressure.

Volume and temperature. Now let's study another aspect of Charles' law



$$\frac{V_1}{V_2} = \frac{T_1}{T_2} \quad (a) \qquad \frac{P_3}{P_2} = \frac{T_3}{T_2} \quad (d) \qquad T_1 \frac{V_3}{V_1} = T_3 \frac{P_1}{P_3} \quad (g)$$

$$\frac{V_1}{V_3} = \frac{T_1}{T_2} \quad (b) \qquad \frac{P_3}{P_1} = \frac{T_3}{T_2} \quad (e) \qquad \frac{P_1 V_1}{T_1} = \frac{P_3 V_3}{T_3} \quad (h)$$

$$T_2 = T_1 \frac{V_3}{V_1} \quad (c) \qquad T_2 = T_3 \frac{P_1}{P_3} \quad (f) \qquad \frac{PV}{T} = R \quad (i)$$

3 General gas equation $PV/T = R$ may be derived by using constant-volume and constant-pressure versions of Charles' law on three states of a perfect gas. Two of states must have same pressure, one of these and the third state, same volume

Perfect gas equation proves to be most important thermodynamic tool

by keeping the pressure constant and letting the volume vary as the temperature changes. In Fig. 2 we enclose a constant weight of gas in a cylinder and piston. The piston carries a constant weight, W, that keeps a constant pressure on the trapped gas. We bring the gas to the same temperatures as in Fig. 1 and note the changes in volume. The graph of Fig. 2 shows the plot of V, cu ft per lb, versus T. The points lie on a straight line. Extrapolating the line shows that it passes through zero volume when the temperature falls to – 460 F or 0 °R. This gives us the other aspect of Charles' law: When pressure of a gas is held constant, its specific volume varies directly with its absolute temperature.

We can write equations for this part of Charles' law in the forms:

$$V = CT \text{ or}$$

$$\frac{V_1}{V_2} = \frac{T_1}{T_2}$$

We can also explain this behavior by our molecular theory. As the gas molecules absorb energy their speeds increase. This raises the number of collisions per second with the cylinder wall and piston. Greater number of collisions on the piston raises the gas pressure, moves the weighted piston upwards. This increase in volume causes the vertically moving molecules to travel a longer distance between collisions, and so drop the gas pressure to the level where it again balances the weighted piston.

Perfect gas equation. Actual gases do not comply strictly with Charles' law. But in most working ranges, the law can be applied to practical problems with sufficiently close results. The two parts of Charles' law, Fig. 1 and 2, can be combined into a single expression known as the perfect gas equation. Fig. 3 shows how they combine with the following reasoning:

P is pressure in psf, V is specific volume in cu ft per lb of gas and T is the gas absolute temperature in °R. In Fig. 3 we have a fixed weight of gas in state *1*, with pressure P_1, temperature T_1 and volume V_1. We then heat the gas till it reaches state *2*, but its pressure P remains constant so that $P_1 = P_2$, but its volume and temperature have increased to V_2 and T_2.

The PV graph at right of Fig. 3 shows the change in state. Next, we hold the gas volume constant and heat the gas some more so that its pressure rises from P_2 to P_3, but $V_2 = V_3$ and T_2 rises to T_3.

Now let's explain the equations. Formula *a* is the simple statement of the constant-pressure Charles' law. But the two changes of state as shown in the graph of Fig. 3 show that $V_3 = V_2$. Substituting in *a* we can write *b*. Solving for T_2 we get equation *c*.

From the constant-volume Charles' law we get equation *d*. But the graph shows us that $P_2 = P_1$, so substituting for P_2 we get equation *e*. Solving for T_2 we get equation *f*. Equations *c* and *f* give us two expressions for T_2. By simply equating the right-hand sides we get equation *g*. Rearranging the terms gives us *h*. This tells us that dividing the product of pressure and volume at any state by the absolute temperature at that state will be the same as the product of pressure and volume divided by absolute temperature at any other state for the same

1 — Gas constants for perfect gas equation

Gas	Gas constant R, ftlb per lb, F
Dry air	53.3
Carbon monoxide (CO)	55.2
Hydrogen (H_2)	767
Nitrogen (N_2)	55.2
Oxygen (O_2)	48.3
Helium (He)	386
Carbon dioxide (CO_2)	35.1
Water vapor (H_2O)	85.8

mass of gas. We can generalize this by equation *i* which says that for any state $PV/T = R$ where R is the gas constant, it differs for each gas. Table, p 100, lists the gas constants for eight different gases. (Don't confuse R for degrees Rankine, °R.)

Beauty of the perfect gas equation is that it gives us both Boyle's and Charles' laws. By keeping T constant we get $PV = C$; keeping P constant we get: $V = CT$ or keeping V constant we have: $P = CT$, the C's being all different constants.

In studying thermo, we'll find that plotting gas changes on PV co-ordinates, simplifies understanding of the processes. So let's plot the perfect gas equation for one pound of dry air, Fig. 4. Here we have a series of Boyle's law curves for even values of absolute temperatures. Study the curves for future reference.

Properties. Temperature, pressure and volume are called properties of a gas. If we know two of them, we automatically can find the third by the perfect gas equation. This assumes, of course, that we know the kind of gas. These properties also measure the relative amount of internal energy that a gas contains; more on this in later articles.

Problems. To check our understanding of the perfect gas equation let's use it in several examples.

Example 1. Two tanks, each 4-ft dia and 8-ft long internally, are connected by a pipe and valve. With the valve closed, tank A contains ½ lb CO_2 at 60 F, and tank B, 3 lb CO_2 at 60 F. (a) Find the gas pressure in each tank with the valve closed. (b) What is the common pressure after opening the valve, assuming the temperature stays at 60 F?

Solution: First let us find the volume of each tank:

$= \pi(d/2)^2 L$

$= 3.14(4/2)^2 \times 8 = 100.5$ cu ft

Tank A. Next, let's find the pressue of CO_2 in tank A. From the table we find for CO_2, $R = 35.1$. Temperature of CO_2 is $60 + 460 = 520$ °R. Specific volume of the gas is $V = 100.5/0.5 = 201.0$ cu ft per lb. From perfect gas equation $PV = RT$ we can find:

$P = RT/V = 35.1 \times 520/201.0$

$= 90.8$ psfa

Tank B. Now let's find the specific volume of CO_2 in Tank B:

$V = 100.5/3 = 33.5$ cu ft per lb

Now we're ready to compute its pressure:

$P = RT/V = 35.1 \times 520/33.5$

$= 545$ psfa

After opening valve. Gas from B flows into A until both have same pressure. With valve open, total volume equals sum of both tanks. Then specific volume of mixed gases:

$V = (100.5 + 100.5)/(3.0 + 0.5)$

$= 57.4$ cu ft per lb

Pressure in both tanks:

$P = RT/V = 35.1 \times 520/57.4$

$= 318$ psfa

Answers: (a) Tank A pressure = 90.8/144 = 0.631 psia. Tank B pressure = 545/144 = 3.78 psia. (b) Common pressure = 318/144 = 2.21 psia.

Example 2. An unlabeled gas bottle holds 5 cu ft of gas that weighs 20 lb and exerts a pressure of 763 psig at 120 F. What gas does it contain?

Solution: $V = 5/20 = 0.25$ cu ft per lb

$P = (763 + 14.7)144 = 112{,}000$ psfa

$T = 120 + 460 = 580$°R

$R = PV/T = 112{,}000 \times 0.25/580 = 48.3$

Comparing R with the constants listed in the table, opposite page, the gas must be oxygen.

Example 3. An inflated automobile tire has a volume of about 1300 cu in. With an air temperature of 60 F it has an air pressure of 25 psig. (a) What will be the air pressure when the temperature rises to 120 F? (b) How many lb of air does the tire hold?

Solution: First let's convert these units so we can use them in the perfect gas equation.

$P_1 = (25 + 14.7)144 = 5720$ psfa

$T_1 = 60 + 460 = 520$°R

$T_2 = 120 + 460 = 580$°R

$$\frac{P_2}{P_1} = \frac{T_2}{T_1}$$

$P_2 = P_1T_2/T_1 = 5720 \times 580/520$

$= 6380$ psfa

or $(6380/144) - 14.7 = 29.6$ psig at 120 F—*answer to (a).*

To find the air weight we first look up air in the table and find $R = 53.3$. Then at 25 psig and 60 F, specific volume for air is:

$V = RT/P = 53.3 \times 520/5720$

$= 4.85$ cu ft per lb

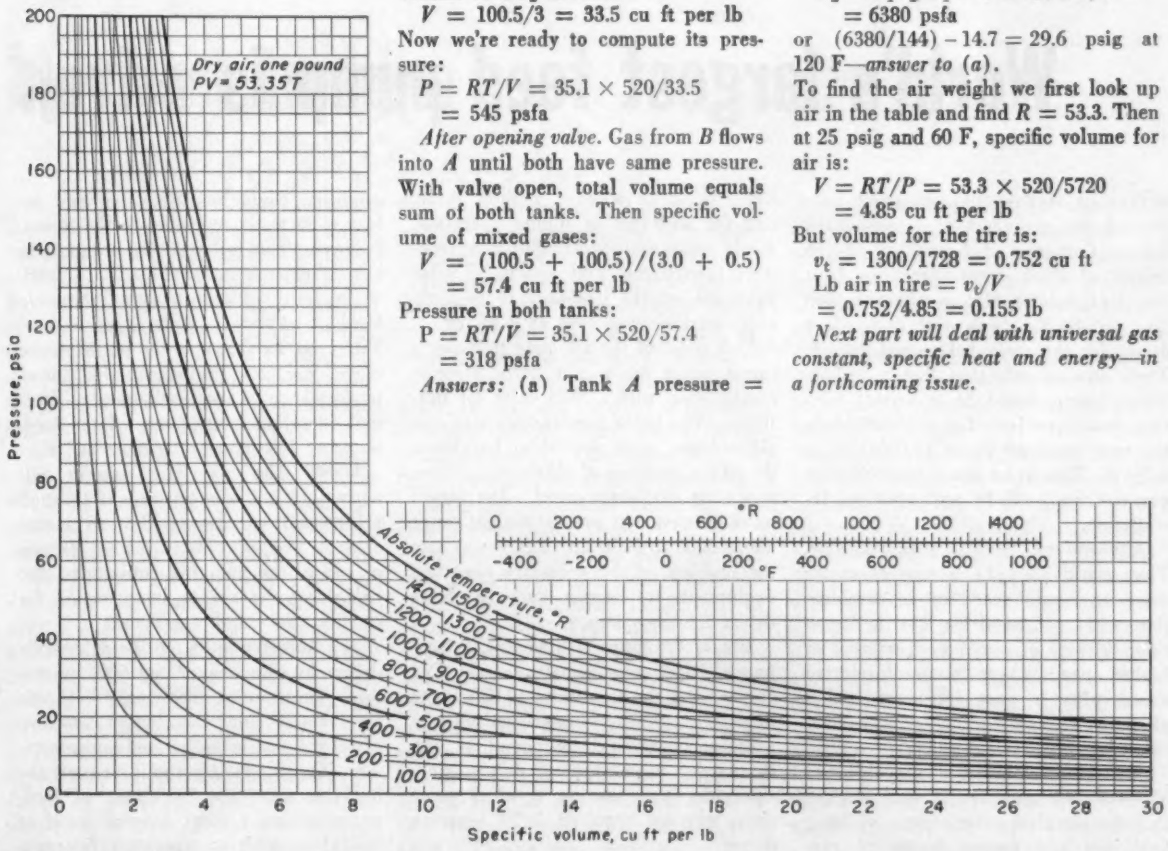
But volume for the tire is:

$v_t = 1300/1728 = 0.752$ cu ft

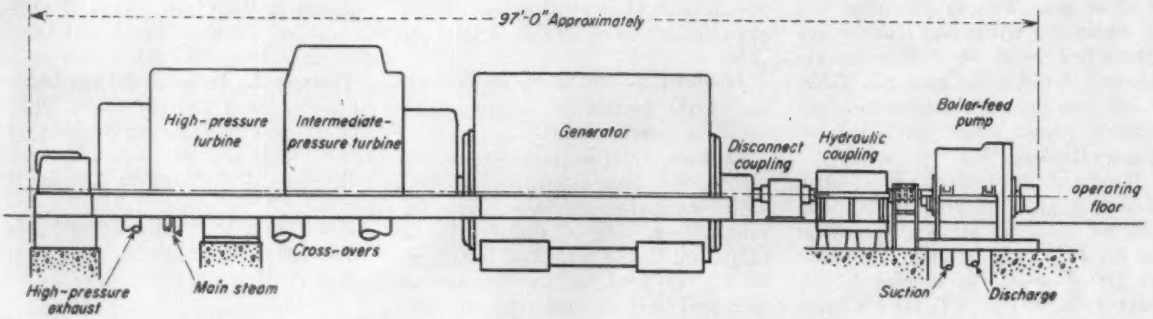
Lb air in tire $= v_t/V$

$= 0.752/4.85 = 0.155$ lb

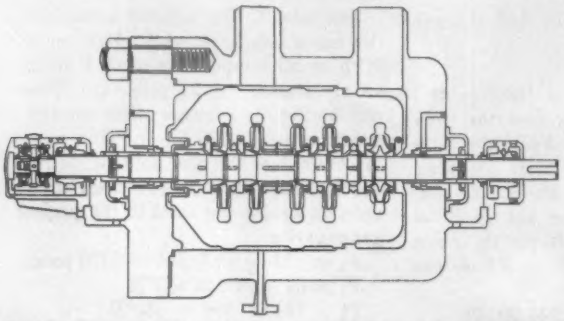
Next part will deal with universal gas constant, specific heat and energy—in a forthcoming issue.



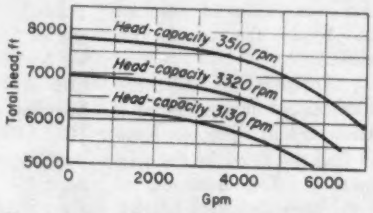
4 Pressure-volume relations for one pound of air tie together Boyle's and Charles' laws. Pair of adjacent scales show how Fahrenheit and Rankine temperatures are numerically related. General appearance of these curves are important



1 Complete generating unit, showing the boiler-feed pump at the right. To the left of it are the hydraulic and disconnect couplings. Latter connects to an extension of the main generator shaft. Total overall length is about 97 ft



2 Cross section of pump to be used in this installation. It is a 5-stage unit having a double-suction first stage



3 Head-capacity characteristics of feed pump at its various operating speeds

World's largest feed pump is driven

► ONE OF MANY PROBLEMS which confronted the engineers of Consolidated Edison Company of New York in the design of their record-breaking Unit No. 3 at Astoria Station (POWER, Jan '56, pp 84-85) was selection of a driver for the main boiler-feed pumps. Their studies indicated that a full-capacity pump would be a logical solution, but it presented a problem since the unit required about 12,000 bhp to drive it. This was a much higher horsepower than used in any previous installation.

Alternatives. Several were available. They could use (1) a regular motor drive at 2-pole speed or in combination with a fluid drive (2) a direct-drive turbine at either conventional or higher speeds (3) a motor of selected speed plus a gear increaser, either alone or in combination with a fluid drive for conventional or higher speeds.

Since dependability of the unit was of prime importance, it was obvious that the simplest arrangement utilizing flexibility and proven operating procedures would be the most desirable. Slow-speed motors with gear increasers, either with or without a fluid drive, and for 3600-rpm or higher operation, would mean additional equipment, controls, auxiliaries and space. Similar problems existed if a normal- or high-speed turbine was used as a driver.

This reduced the selection to either a direct motor drive or a motor drive in combination with a fluid drive for flexibility. The latter combination was considered the most desirable, but introduced the problem of obtaining a driver operating at 2-pole speed. The larger units in service at present do not range above 4000 to 5000 hp. There was also the problem of the necessary electrical equipment to handle such a large driver for the pump.

Use of the main turbine as the feed-pump driver was a natural selection. It provided the necessary 12,000 hp to drive the pump without adding the additional controls, equipment or piping needed for a separate driver. Considerable space saving resulted since room was not required for a separate driver.

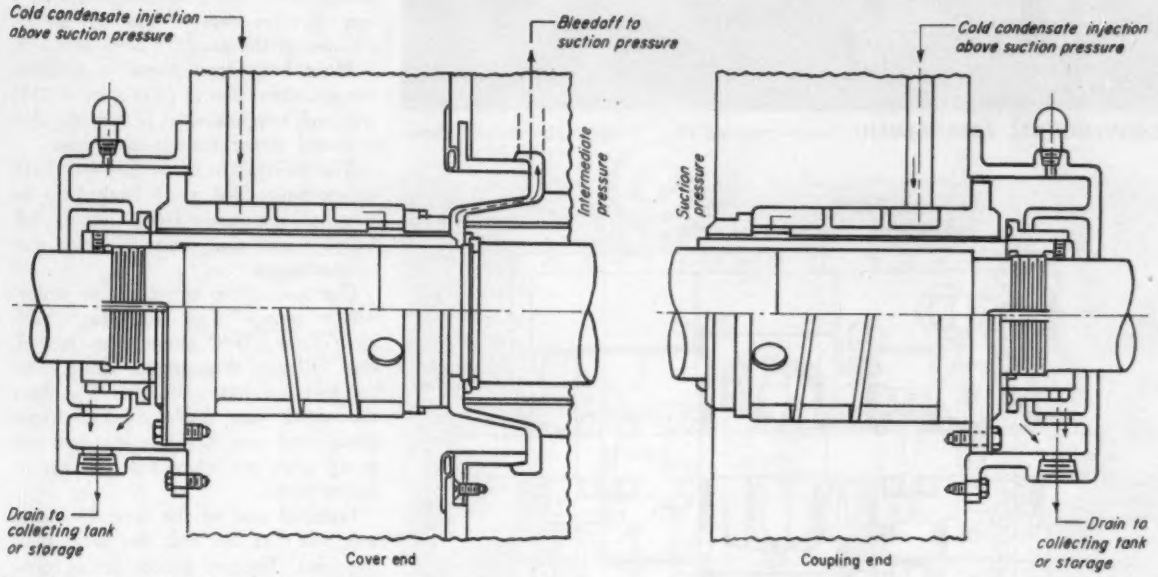
Once the final drive arrangement had been determined the pump's operating condition could be crystalized and information made available to the manufacturer. The full-capacity pump is to have a capacity of 6330 gpm of feedwater delivered against a total dynamic head of 6400 feet. Full speed will be 3510 rpm, as shown in the performance curve, Fig. 3. The curve also shows performance at reduced speeds. Normal operating temperature of the feedwater at full capacity will be 363 F.

Load. The main feed pump will normally handle the entire load through all normal variations. But, to insure against loss of output during failure of any of the pumping equipment, two half-size units are to be provided for startup and standby service.

The half-size units will be separately driven by direct-connected 6000-hp motors. These units, while only half size for the particular installation, are also of record size in boiler-feed-pump service. The operating conditions of the half-size units are 3165 gpm of feedwater against a total dynamic head of 6650 feet. with an operating temperature of 363 F.

In pioneering an installation of this

Stuffing-box design is important in the operation of feed pumps


Cold condensate injection above suction pressure
Bleedoff to suction pressure
Intermediate pressure
Drain to collecting tank or storage
Cover end
Cold condensate injection above suction pressure
Suction pressure
Drain to collecting tank or storage
Coupling end

4 Throttle-bushing type of stuffing box with cold condensate injection at a pressure above the suction pressure. The condensate temperature in this unit should not exceed 200 F. There are some slight differences in the design at each end

by main turbine

By THOMAS HALL
Byron Jackson Div, Borg-Warner Corporation

type, and particularly of this extremely large size, the engineers in charge knew they would have to have a pump with great reliability, since failure of the unit would effect a large portion of the station output. Even though standby units are capable of carrying the total load, any failure of the main feed pump would hamper operations considerably, although it would not necessarily require a shutdown of the main turbine and generator. There would be interference with normal operations on the main turbine floor plus work involved in any repairs.

Reliability pointed out simplicity, and the pump manufacturer was charged with providing such a unit. The very latest in design and application were desired, but with the condition that nothing of an untried or unproven nature would be used.

Operating conditions were such that it was possible to select the hydraulic design in a specific-speed range that would insure high efficiency. A 5-stage pump with a horizontally-split inner case, Fig. 2, was selected. The first stage is double suction, with the other four stages arranged in pairs of single-suction impellers thrusting in opposite directions.

The double-volute design is used in the inner case. This provides radial balance by maintaining equal and opposed forces 180 deg apart. A double-suction impeller is hydraulically-balanced axially, and the pairs of opposed impellers provide equal thrust in opposite directions. This means that the entire unit is in axial as well as radial balance—no additional balancing devices are required.

With this arrangement even localized wear at any particular point within the pump causes minimum thrust load in either direction. This insures against thrust-bearing loading causing a problem at any time. The suction pressure provides adequate npsh; however, the double-suction first stage provides an additional margin of safety. As is standard procedure in boiler-feed pump design, shaft span and deflection are held to a minimum so that no problems will arise if suction pressure is lost.

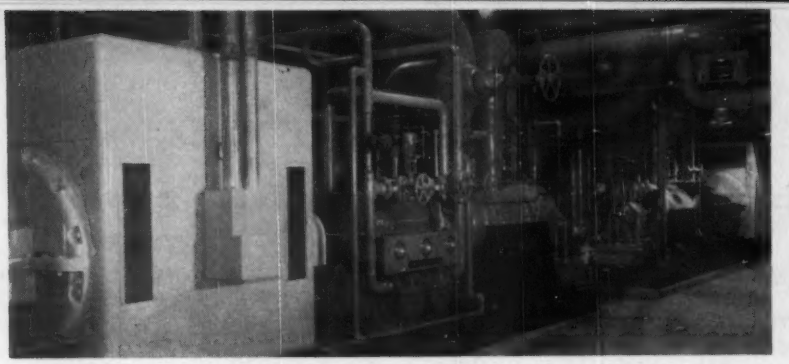
Alignment. To insure reliability, alignment of all the component parts of the unit is a requisite for successful operation without any possibility of seizure caused from misalignment. A minimum of joints or fits, together with accurate machining of all these parts, assists in providing this assurance.

The horizontally-split inner case provides the best possible answer to the internal alignment of this pump since there is only one joint. Only three joints remain for alignment of the entire unit; the barrel-to-cover fit and the two volute fits, one to the inner end of the barrel and the second to the cover. A further aid to alignment is the practice of bolting the cover metal-to-metal with the barrel. This prevents any possibility of bearing misalignment relative to the rest of the pump, as bearings are dependent on the barrel-to-cover connection for alignment.

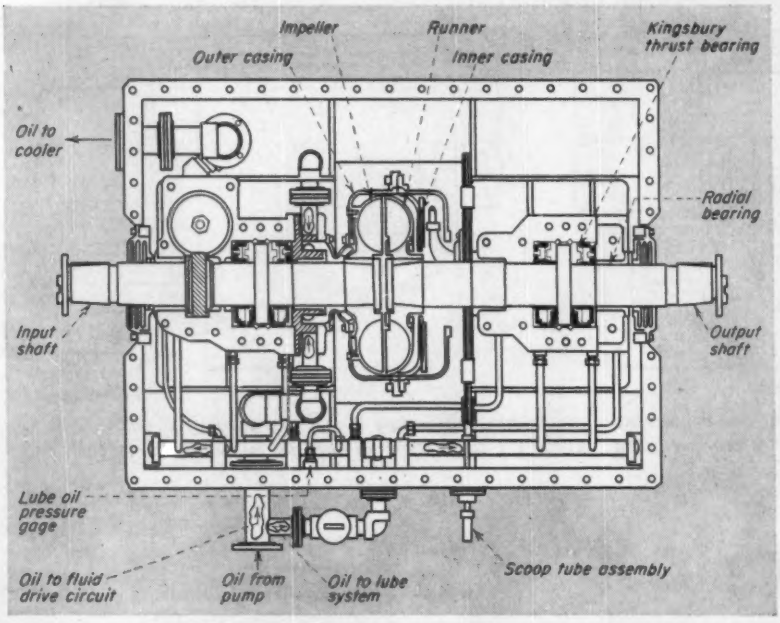
One of the more interesting problems involved provision of a suitable joint for the barrel-to-cover fit which would prevent leakage, since the pump might be subject to rapid temperature changes, cold-water operation, etc.

Stuffing-box design was of particular

(*Continued on page* 177)



CONVENTIONAL ARRANGEMENT: motor-powered fluid drive for boiler-feed pump



FLUID DRIVE for Astoria has separate oil cooler instead of the usual integral one

Selecting the largest feed-pump drive

Here's the thinking behind the unique boiler-feed pump drive soon to be installed at Astoria No. 3

► WHILE USING a single full-sized boiler-feed pump driven directly by the main turbine has been considered in the past, it is only now becoming feasible. The 335,000-kw turbine-generator for Unit No. 3 at Astoria Station of Consolidated Edison Co of New York requires excitation greater than that which a direct-connected exciter could supply. So separate excitation is used, leaving the outboard end of the generator shaft available for driving a boiler-feed pump.

Pump is connected to the generator shaft through a variable-speed fluid drive, Fig. 1, p 102. A separate shear-type disconnect coupling is provided between the generator and the fluid drive. This coupling is especially made to take up the expansion in the turbine-generator shaft.

The fluid drive, made by American Blower Division of American Radiator and Standard Sanitary Corp, provides a slip device to eliminate damage to the main unit if the pump "freezes" during operation. The variable-speed feature permits changing pump speed to control boiler-drum water level.

This arrangement drives the pump with minimum losses. With a conventional drive, where motor is direct-coupled to the pump, there are electrical losses in the generator, transformer and motor, as well as transmission losses. Also, the regulating-level control valve imposes a 3 to 5% loss because of the pressure drop across it.

Main boiler-feed pump is designed for maximum flow of 6330 gpm at 2440 psi, and requires over 11,000 hp. Anticipated power savings are large.

The decision to use a full-size shaft-driven boiler-feed pump backed up by two half-size motor-driven pumps followed a cost comparison of three possible schemes.

One would use two half-size motor-driven pumps plus one spare half-size motor-driven pump; the second, one full-size shaft-driven pump plus two half-size spare motor-driven pumps; the third, one half-size shaft-driven pump and one half-size motor-driven pump plus one spare half-size motor-driven pump.

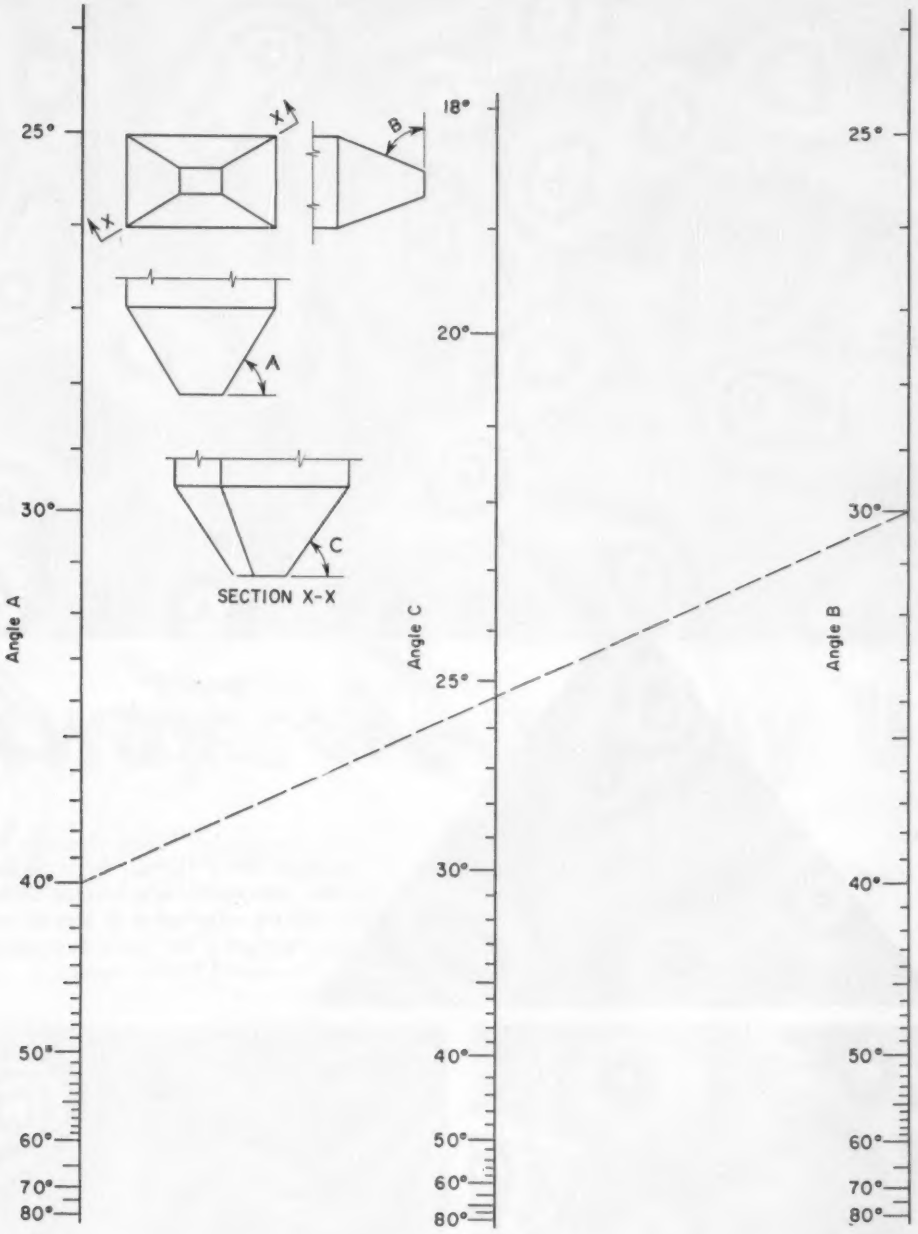
Installed cost of the second scheme was less than the first, but more than the third. The real savings are in operating costs. In addition, if this scheme works out successfully, it will permit eliminating the two half-size spare pumps in future installations, substituting only a small start-up pump.

Sketch at left shows a fluid drive similar to the one for Astoria No. 3. The scoop-tube position controls oil level in the impeller and runner casing, thus controlling output speed and power. Output can be adjusted from maximum to zero pump delivery.

How it operates. An oil pump circulates a continuous fixed oil supply from a stationary reservoir to the working circuit. Centrifugal force distributes the oil through the rotating parts, forming a ring of fluid. A series of transfer holes in the inner casing permits oil in the working circuit to flow freely into the scoop chamber between inner and outer casings, so level there is the same as in the impeller and runner circuit. The scoop tube trims oil from the rotating ring in the chamber and returns it to the sump. Therefore, scoop-tube position regulates output speed and power.

A separate pneumatic controller, built by Bailey Meter Co, regulates position of the scoop tube. Thus, drum water level is controlled by pump speed rather than by a regulating valve.

Oil cooler and separate oil pump in the Astoria unit are different from those usually supplied with this type of drive. Oil cooler is separate, not integral as in standard units; oil pump is motor-driven, instead of being geared to the input shaft.



Valley slopes for bin hoppers

► SLOPES of hopper bottoms must be steeper than the angle of repose of the material stored. The limiting angle is the valley angle, the angle between the joints of the sloped bottoms and the horizontal, angle *C*. Knowing the angles of the hopper bottoms, *A* and *B*, we then can figure *C* by the formula:

$$\text{Cot}^2 C = \text{Cot}^2 A + \text{Cot}^2 B.$$

This chart eliminates the need of referring to trig tables. Simply spot *A* and *B* on the scales above; draw a straight line between the two; intersection of the line with middle scale gives the corresponding value of *C*.

A DI LORENZO *Brooklyn, N. Y.*

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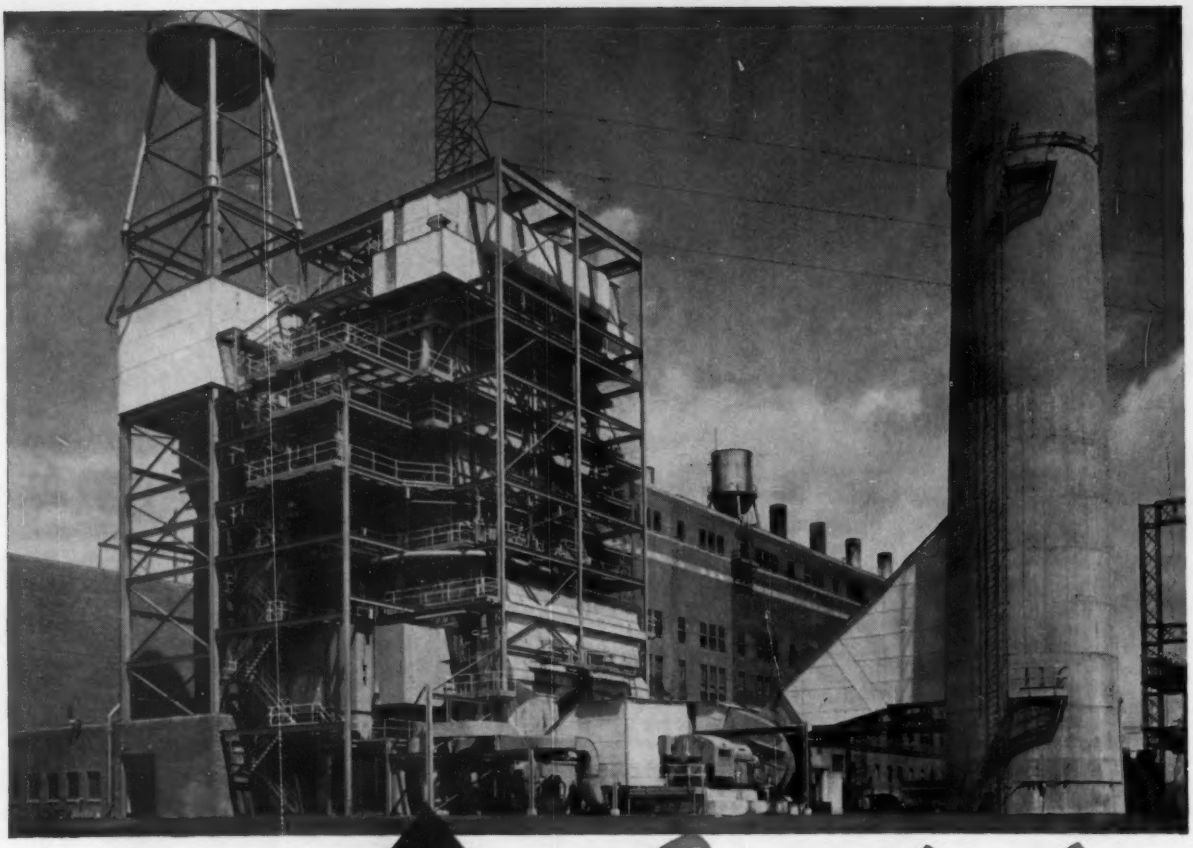
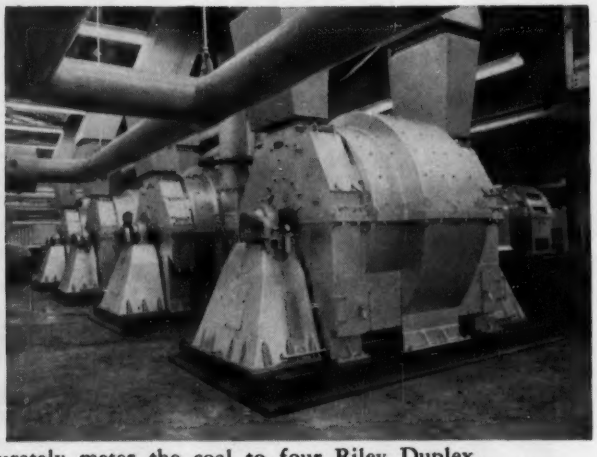


On the line.

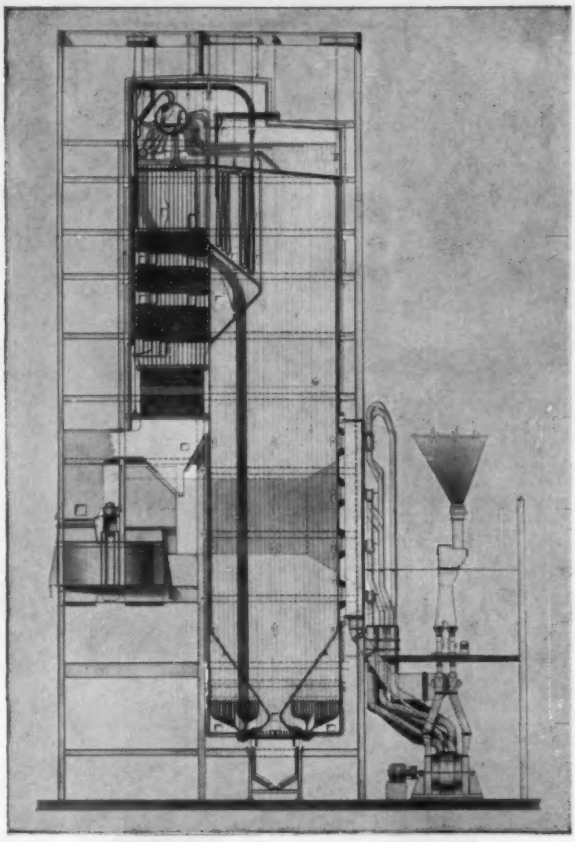
Actual unretouched burner elevation view inside Picway's Riley Furnace after 80,000 tons of low ash fusion temperature coals had been fired. Low incidence of slag formation around burners is due to the Riley design of water-cooled burner throats.



Eight Riley Coal Feeders at Picway Station accurately meter the coal to four Riley Duplex Pulverizers. Riley Pulverizers are distinguished for their quiet, smooth, vibrationless operation, their ability to respond to rapid load swings, and their ability to handle wet coals. Tungsten Carbide faced pulverizing elements assure sustained high fineness and low maintenance.

THE new 100,000 kilowatt electric generating unit recently placed in service at Columbus and Southern Ohio Electric Company's Picway Generating Station located a few miles south of Columbus, Ohio, is supplied by a 900,000 lb/hr. Riley Unit that is designed to operate as a swing load unit using Ohio Strip Mine Coals.

The unit features an ample furnace and is fired by four Riley Duplex Pulverizers and twelve Riley Flare Type Coal Burners. This combination of Riley equipment is ideally suited to meet the wide swings in load of the new generating unit.



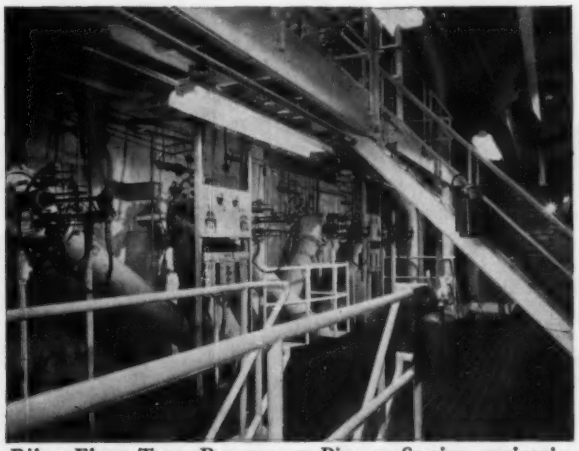
Picway's New Riley Unit

This new generating unit of Picway Station increases the total installed generating capacity of Columbus and Southern Ohio Electric Company to 560,000 kilowatts, representing an increase of 165% during the past 10 years.

Engineering Data

Maximum steam capacity —	900,000 lbs/hr.
Design Pressure	1500 psig
Steam Temperature	950 F

Commonwealth Associates, Inc., Engineers



Riley Flare Type Burners at Picway Station maintain continuous, stable ignition at low loads. A common air duct supplies secondary air. Direction and rotation of burner flames is by remote control.

A survey of your plant by a consulting engineer could show ways of making surprising savings in your power costs.

RILEY

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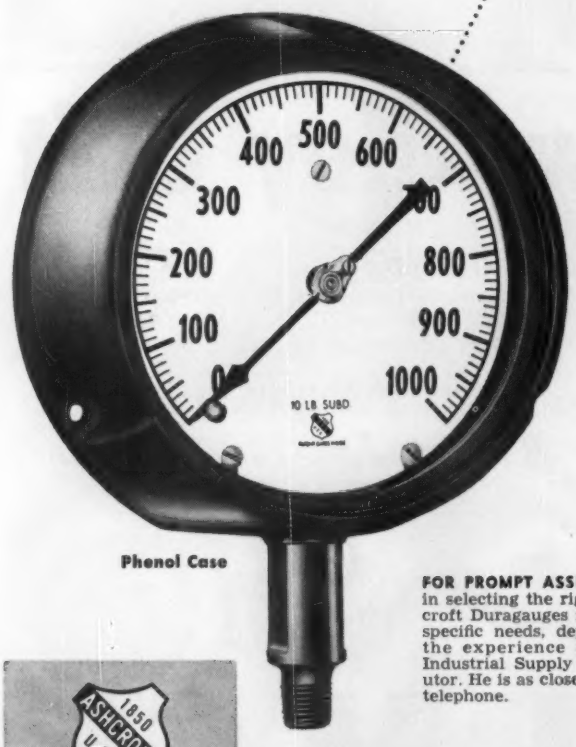
Alumalife® Case



Phenol Case

Why do ASHCROFT DURAGAUGE **CASES** increase service life?

Duragauge casings add extra-long service life to Duragauges because they're available in three different materials: you can choose the case-material that stands up best in *your application.* You have a choice of *Alumalife®* – a special aluminum alloy; *Cast Iron,* rugged and durable; and *Phenol,* a tough, rigid plastic.

Duragauge casings are dust and moistureproof. Chrome-plated, die-cast retaining rings keep the dial cover glass tightly in position and prevent the entrance of dirt or harmful fumes. Depending upon material, casings are Bonderized and the ring is Anodized and dichromate sealed for protection from corrosion.

For added protection, there is the Maxisafe Duragauge casing with a solid front – a special design for maximum safety and ease of maintenance. Duragauges are easy to service since Duragauge casings are constructed so that the entire system – socket, tube, tip, movement, dial and pointer – can easily be removed as a unit.

Lifetime Duragauge cases are available for numerous dial sizes. You have a choice of Bourdon tube materials, a wide range of pressures, and a movement made completely of stainless steel or stainless steel with nylon bearings and pinion gear.

Whatever case material and gauge system is best for your needs, you can rely on the Ashcroft Duragauge for highest sustained accuracy and long service life.

FOR PROMPT ASSISTANCE in selecting the right Ashcroft Duragauges for your specific needs, depend on the experience of your Industrial Supply Distributor. He is as close as your telephone.

In Canada: *Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario*

ASHCROFT GAUGES

A product of **MANNING, MAXWELL & MOORE, INC.** STRATFORD, CONNECTICUT

MAKERS OF 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'ASHCROFT' GAUGES, 'CONSOLIDATED' SAFETY AND RELIEF VALVES 'AMERICAN-MICROSEN' INDUSTRIAL ELECTRONIC INSTRUMENTS, *Stratford, Conn.* 'HANCOCK' VALVES, *Watertown, Mass.* 'CONSOLIDATED' SAFETY RELIEF VALVES, *Tulsa, Okla.* AIRCRAFT CONTROL PRODUCTS, *Danbury & Stratford, Conn. and Inglewood, Calif.* "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES, *Muskegon, Mich.*

G4-56

STEVE ELONKA
Associate Editor in Charge

IMPROVEMENT MADE by treating Bay water is shown in the glass indicators here

Dofasco
PIG IRON • STEEL CASTINGS • STEEL PLATE
TIN PLATE • COLD ROLLED PRODUCTS
HOT ROLLED SHEETS • GALVANIZED SHEETS
DOMINION FOUNDRIES & STEEL LTD.

Canada's fourth largest steel producer saves $100,000 a year . . .

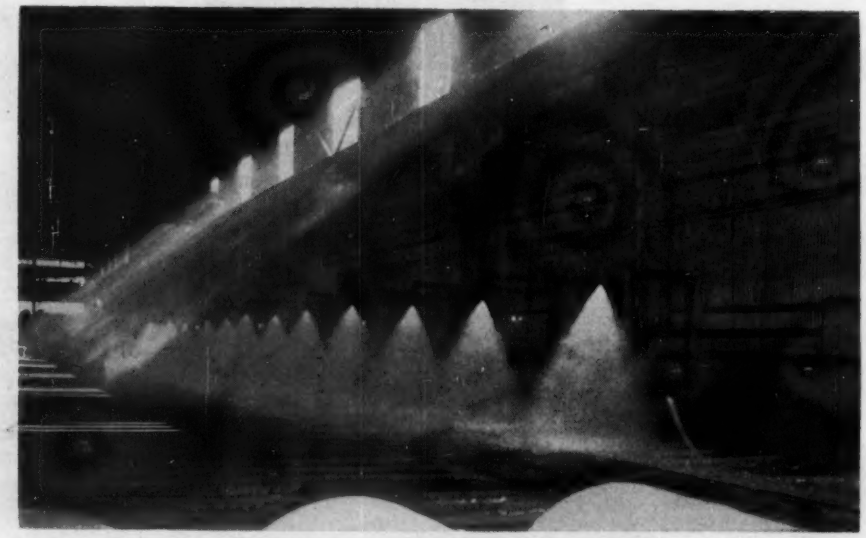
Cleaning a turbid water supply

► PURIFICATION of a water to be used industrially in various cooling processes was a serious problem for Dominion Foundries and Steel Limited, Hamilton, Ontario. Known throughout Canada as "Dofasco," they have spent about $50 million in the last five years on various expansion programs. These vast expansions produced a big headache. They created a need for larger quantities of water which had to be industrially clean, odorless, reasonably priced and suitable for utilization in cleaning manufactured bar stock and cooling the rolling mills.

Water use. It became apparent to Dofasco in 1952 that it would be profitable to operate their own water-purification plant, as completion of the early phases of the expansion program

DOFASCO'S INTAKE PIPES are under the boardwalk, *left*. City's sewage outlet to the Bay is the pipe only a few yards to the right. The proximity created problems

BAY WATER as it reaches the treatment plant. Daily flow is 11 million gallons



JETS OF INDUSTRIALLY-CLEAN WATER are sprayed on the rolled-steel plate in final cooling process at Dofasco's rolling mill. Clean, odor-free water is important in this application

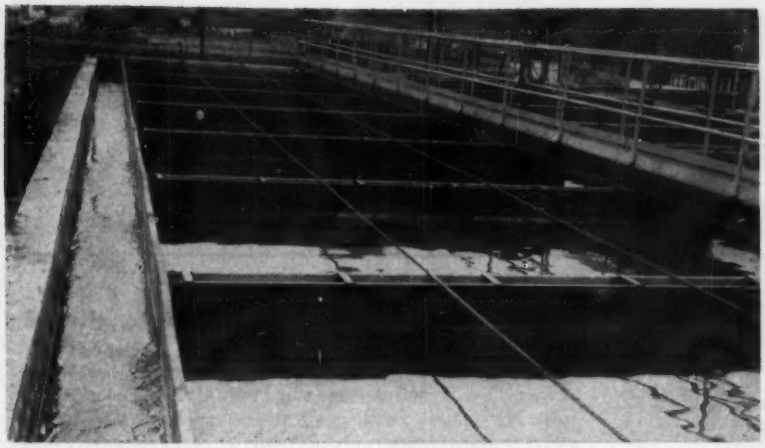
Successful treatment of 15 million gallons of water takes equipment, skill

was beginning to make the water supply a costly and complicated proposition. Daily requirements at that time were in the vicinity of 9 million Imperial gallons. Of this total, Dofasco was using 4.5 million gallons of city-treated water at a cost of $0.15 per 1000 gallons. This meant an annual bill from the City of Hamilton of approximately $250,000.

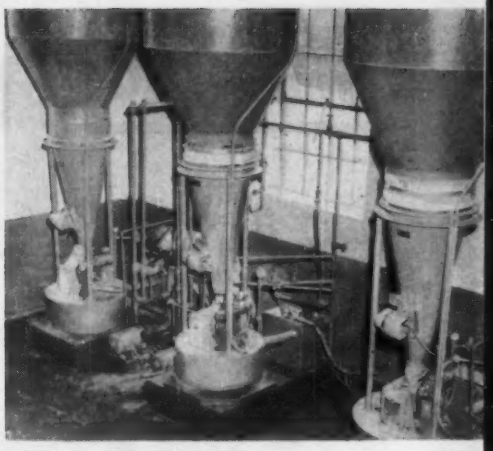
Bay water. The balance of these 1952 requirements—4.5 million gallons—was drawn through the company's own pumps from the rather murky and very turbid water of nearby Hamilton Bay. Maximum turbidities ran over 200 ppm and averaged over 40 ppm. These high turbidities often lasted for periods of one to two weeks.

This was further complicated by contamination with chemical wastes and sewage. Additionally, the pH of the raw water often went down to an average of 5.0 when acid wastes from surrounding industry were dumped into the Bay. At that time, the supply was screened to remove coarse solids. However, mud, silt and other finely-divided material was not removed and as a consequence pipes and mains carrying the water would clog, presenting costly maintenance and repair problems. Also, odor from the Bay water used in the plant processes was anything but pleasant.

Pumps. To add to the difficulties, the City of Hamilton's own pumping and filtration facilities were often strained during hot-weather periods. Peak domestic demands, coupled with Dofasco's usage, sometimes meant that certain sections of the city would have

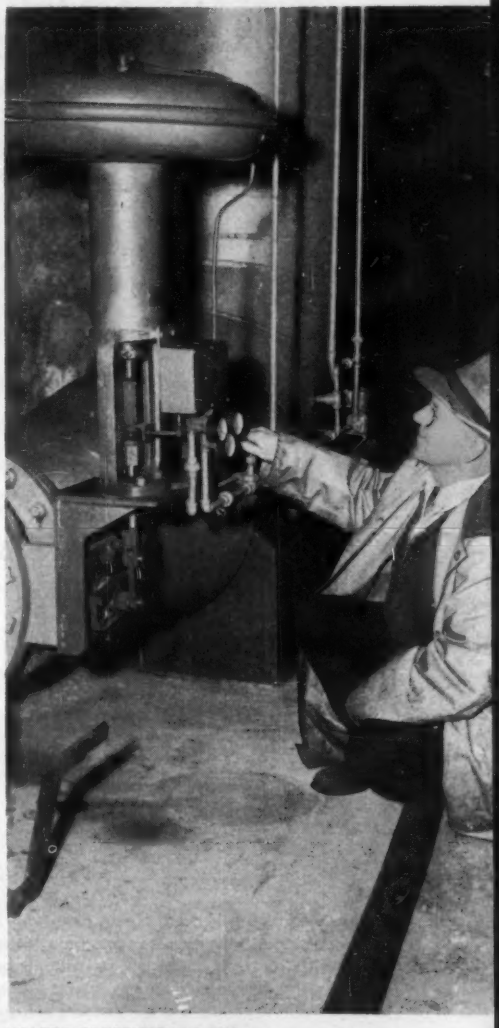


TWO PRECIPITATORS are used for softening and coagulating purposes. Each unit has a capacity of 5200 Imperial gpm. The results obtained are highly satisfactory



CHEMICAL FEEDERS feed the necessary lime, alum and clay into water supply

PURIFICATION-PLANT EMPLOYEE, James Rattray, making a chemical test of water after it has been treated in the plant. Constant checks of the water are made



WATER-PRESSURE GAGES being watched by K J Mackenzie, plant's chief engineer

low water pressure and be short of water. This prompted official requests from the city fathers to Dofasco and other industries in Hamilton to try-to-go-easy on utilization at these times. Therefore, the company felt a moral obligation to relieve the shortage and at the same time make itself partially independent of the city system.

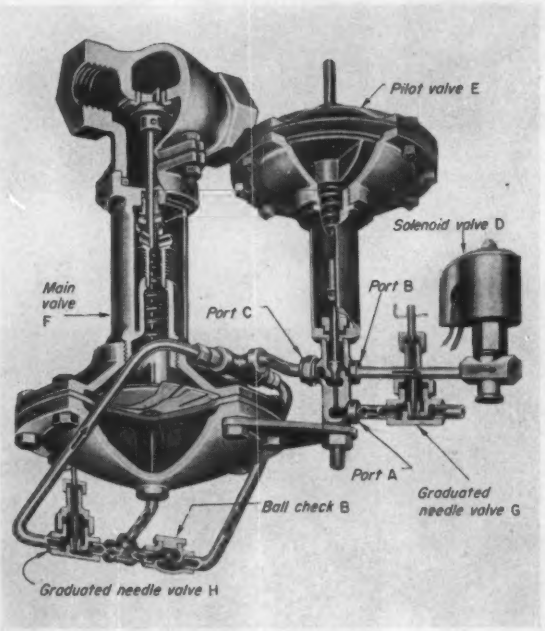
Purification. When the decision was made to install and operate their own water-purification plant, Dofasco put itself in a position to gain four important benefits: (1) secure a plentiful supply of water (2) fulfill its moral obligation to use less city water (3) save money and (4) make working conditions more pleasant for its personnel.

Dofasco engaged the Permutit Company of Canada Ltd, a subsidiary of The Permutit Company, New York City, to install equipment in order to purify water drawn from Hamilton Bay. Two precipitators for (1) coagulation and settling or (2) coagulation and settling plus softening, each with a capacity of 5200 Imperial gpm, were constructed. (*Continued on page* 190)

OPERATORS' NOTEBOOK 101

Now, a new pilot-operated

Valve hookups



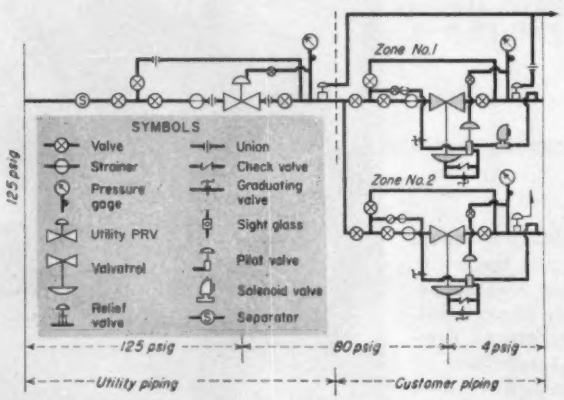
► THIS NEW VALVE can be adjusted for slow opening (up to 10 minutes or more) and fast closing (5 seconds or less). These features permit piping, especially in heating systems, to warm up in unison, thus eliminating thermal shock and operating noise. Further claim is that gradual warming prevents temperature override and cuts system's operating and maintenance costs.

Designed for accurate building and process temperature control, unit reduces steam from full line pressure (600 psi maximum) to usable pressures of high-vacuum heating systems.

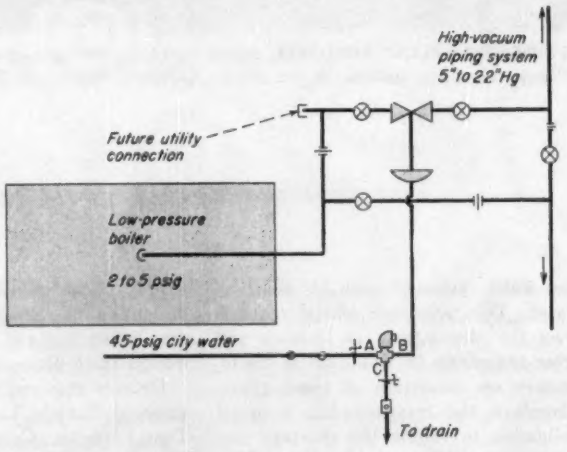
Solenoid valve *D* is in exhaust line of pressure pilot valve *E*. When solenoid valve is closed, full line pressure, through port *A* of pilot valve *E* is exerted against the main valve diaphragm, closing main valve *F*. When the solenoid opens, pressure on diaphragm is released allowing main valve to open. Pilot valve *E* governs the rate of escape according to the downstream pressure. This positions the main valve to pass the correct amount of steam to maintain downstream pressure.

Between port *C* of pilot valve and the main-valve diaphragm chamber are two parallel lines. They transmit pressure to and from the main-valve diaphragm. One line contains the ball check valve *B* that opens toward the diaphragm. When the solenoid valve *D* is shut, line pressure passes through the pilot valve and check valve to main

How valve works



TWO ZONE space-heating piping diagram. Zone 1 has solenoid-operated valve with thermostat. Relay was added so old low-voltage thermostat could be re-used, expenses cut. Zone 2 has second reducing valve, serves cast iron radiators in furniture-refinishing room. Here reduced pressure is constant around clock to speed drying of finishes. These reducing valves are set to open in 6 and 4 minutes, close in just a few seconds



LOW-PRESSURE heating system has one control valve. Here's sequence of operation: (1) Solenoid unenergized, ports *A* and *B* open, *C* closed. (2) Solenoid energized, port *A* is closed, ports *B* and *C* are open. (3) Graduating valve to *A* governs speed of closing. (4) Graduating valve from *C* governs speed of opening. Water consumption is about one cup for each cycle of operation. Valve opens in 8 minutes, closes in 2 sec

pressure-reducing valve

By STEVE ELONKA, *Associate Editor*

diaphragm chamber, closing the main valve quickly.

Rate of closing is controlled by graduated valve *G*. Second parallel line contains a graduated needle valve *H*. When solenoid valve is open, pressure on diaphragm is allowed to escape slowly through this graduating valve, allowing main valve to open slowly. Graduating valve permits easy adjustment of main-valve opening time over a wide range, from a few seconds to several minutes.

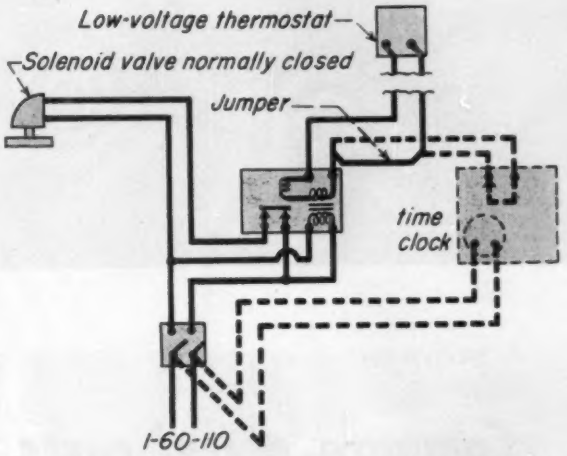
Unit combines functions of both pressure regulator and motorized valve. Large main-valve diaphragm, operating under upstream line pressure, provides enough closing force to overcome minor seat warpage and dirt accumulation from normal operation. This ensures definite dead-end closure.

Ability to adjust opening time of valve makes it possible to set opening rate to suit conditions of each system. Claim is that slow opening lessens water hammer, noise and damage to traps, floats, fittings and valve packings. Slow opening also prevents fast pressure surges downstream. Balance line can be connected immediately downstream of regulator, instead of several feet away, if preferred.

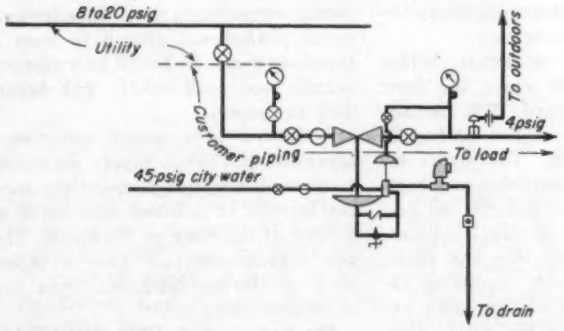
For more information on control valves, see: *Air-operated diaphragm-controlled valve*, pp 118-119, POWER, Oct 1955, *Pressure-pilot single-seated packless regulator*, pp 112-113, POWER, July 1955 and *Self-contained internal-pilot piston-operated valve*, pp 130-131, POWER, June 1954.

—Courtesy, The C E Squires Co, Cleveland, Ohio

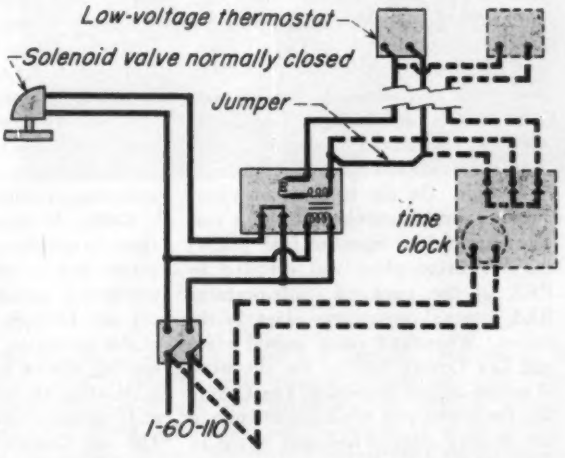
Wiring



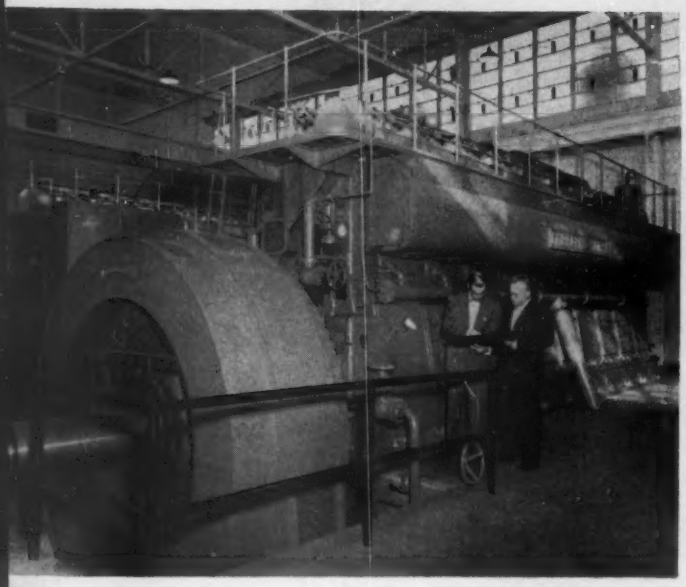
NIGHT SHUTDOWN WIRING of solenoid valve for thermostat heat control. Solid lines show single thermostat control. Dotted lines show optional method of time-clock control with complete night shutdown by adding time clock and omitting jumper. One valve has combination pressure-reducing and steam-control features with slow (variable) opening, quick closing



ROOM HEATING for hotel. Sequence of operation: (1) Solenoid unenergized remains closed. Water pressure through check valve closes main valve. (2) Solenoid energized, opens, allows pressure on main valve to escape through graduating valve that controls rate of valve opening. Opening time for the complete valve travel is set at 12 minutes, closing at 8 seconds. These valves will operate on either water or compressed air



DAY-NIGHT temperature control (optional) is shown by dotted lines. Here, jumper is omitted and second thermostat and time clock added. Solid lines show single thermostat control. Wiring diagram shows method of time-clock operation of control valve. One valve has combination pressure reducing and steam control with slow (variable) opening, quick closing. This hookup can be used for many applications



Wolverine Electric Cooperative

This plant, at Hersey, Michigan, was the most efficiently operated internal-combustion REA plant in the U.S. in 1955. This marked the third time in four years that the plant has won this award. Three 3500-hp dual-fuel diesels, shown at left, produced most of the power at this prize-winning plant

Compare diesel costs with 3 top U. S. plants

► ELEVEN IDENTICAL 3500-hp dual-fuel engines are producing the bulk of the power in three of the nation's most notable REA plants. The plants are: the Wolverine Electric Cooperative's Johnson plant at Hersey, Michigan; the Wheatland Electric Cooperative's Jess Taylor plant at Scott City, Kansas; and the Lea County Electric Cooperative plant at Lovington, New Mexico. The engines are 2-cycle, 10-cylinder, 18x27-in. Fairbanks - Morse dual - fuel units rated at 3500 hp at 277 rpm.

Records. On the basis of operating cost per net kilowatt-hour (with a constant applied to equalize fuel prices) the Wolverine plant was certified by REA as the most efficiently-operated REA internal-combustion plant in the nation. Wheatland rated second place and Lea County fourth. On the basis of actual dollars expended, Lea County had the lowest cost per-kilowatt-hour in the country with Wheatland again in the runner-up position.

Output. In 1955, these three plants generated a combined total of 120,724,-810 kwhr, of which the eleven big engines produced 108,178,500 kwhr. The balance was the output of six smaller dual-fuel engines—a 1650-hp and two 1010-hp Cooper-Bessemers at Wolverine and three 1600-hp Fairbanks-Morse units at Lea County.

Lumping total production for the three prize-winning plants, average fuel consumption for 1955 was 9934 Btu per kwhr. The Wolverine plant was the efficiency leader with an average of 9733 Btu, then Wheatland with 9944 Btu and Lea County with 10,142 Btu. It should be noted that Wheatland has the disadvantage of a 2970-ft elevation and Lea County has to overcome a 3900-ft elevation, a distinct handicap in achieving maximum efficiency.

Costs. In terms of actual dollars spent to produce the power, the three plants had a combined 1955 average production expense of just 5.09 mills per *net* kilowatt-hour. This figure includes operation, supervision and engineering, station labor, fuel oil, fuel gas, lubricating oil, other operating supplies and expenses, maintenance and rents. The Lea County plant, combining 18-cent gas with other low operating expenses, was lowest in the nation with a total operating expense of 4.314 mills per kwhr.

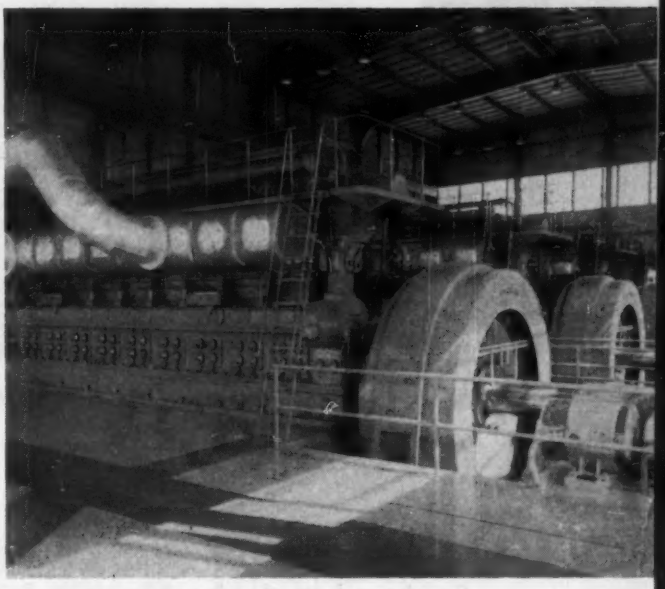
Wheatland had 19.6-cent gas and blended such factors as engine efficiency, low labor cost and particularly low maintenance costs to achieve the fine average of 4.597 mills per kwhr.

Wolverine's plant had the problem not only of 35-cent gas but also of a gas shortage which forced substantial use of even more expensive fuel oil. Excellent engine efficiency and moderate operating costs kept the total expense to 6.5 mills per kwhr.

Plant design. The three notable plants have many things in common besides the big engines that turn out nearly 90% of their power. All are young cooperatives that have experienced phenomenal growth to meet a spiralling demand. Yet all have planned soundly and built solidly with heavy-duty equipment.

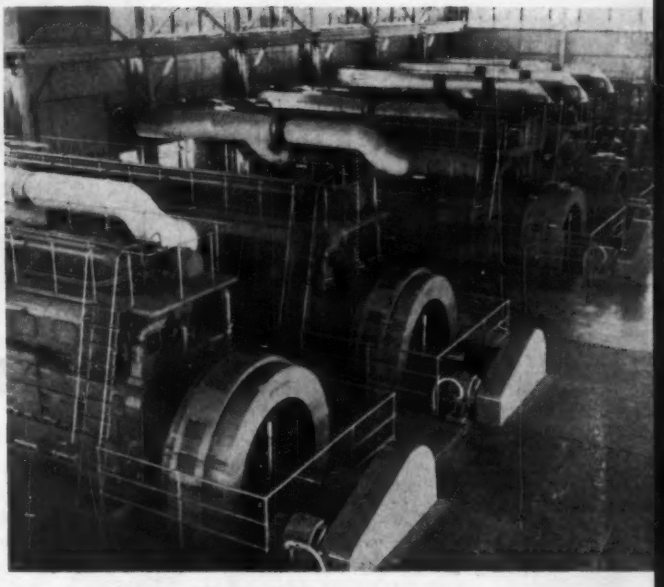
Wolverine is a power cooperative organized in 1949 to supply electricity to three distribution cooperatives serving farmers in a broad area covering a third of the State of Michigan. The new organization took over a power plant at Hersey, Michigan, from one of the member co-ops.

The Hersey plant didn't wait long to win national recognition. For the year 1952, with two of its big engines in service for 12 months and one for better than 10 months, the plant was attested by REA to be the most efficiently operated REA internal-combustion station



Wheatland Electric Cooperative

The Jess Taylor plant at Scott City, Kansas, ran a close second to the Wolverine plant as the nation's most efficient REA plant. All Wheatland's power is produced by the four 3500-hp dual-fuel diesels at the right. These engines are the same as the big units in the other stations shown here



Lea County Electric Cooperative

This plant, at Lovington, New Mexico, had a 1955 total production cost of 4.314 mills per kwhr, the lowest of any REA internal-combustion plant in the U.S. Seven dual-fuel engines generate all the power in this station. Shown at right are four 3500-hp engines (foreground), three 1600-hp units

in the nation. The following year Wolverine actually improved on its award-winning performance and again stood firmly at the top of the heap. In 1955, the Hersey plant took top honors for the third time.

In just four years the Michigan plant has generated 162,337,860 kwhr. Each of the big engines has been on the line about 25,000 hours and produced about 45,000,000 kwhr.

The setting is different but the story is similar in the wheat country of western Kansas where a group of small REA cooperatives banded together in the Fall of 1948 to form Wheatland Electric Cooperative. To provide power for a 2842-square-mile area in Kansas and eastern Colorado, the new combined co-op laid plans to supplant scattered small plants with a large, efficient generating station.

The new power plant went into service in August 1951 with four 3500-hp dual-fuel engines identical to the units then being installed up in Michigan. Because of the altitude, however, they were de-rated to drive 2345-kw alternators instead of 2500-kw alternators similar to the ones at Hersey.

In 1952, the first full year of operation, the engines generated a gross of 22,742,000 kwhr at a respectable production expense of 5.3 mills per net kwhr. Three years later, production

(*Continued on page* 182)

This winter, don't let . . .

Valves and fittings be a bunch of drips! ----------▶

Soot and scale devour your fuel dollars! ----------▶

Tattered insulation make beggars of your boilers! ----------▶

Track down these heating-system

► LAST JUNE (pp 118-119) we talked about cleaning, inspection and layup of heating boilers to protect them against corrosion during the summer, and to make sure they'd be in tip-top shape to go to work when cold weather rolled around again.

Maybe you didn't get a chance to give your boilers a spring cleaning. Or maybe you felt that, since they're only a couple of years old, they're in good shape. Whatever your reason for not doing it then, a complete check of your heating system right now might save you a lot of trouble and expense this winter.

Were there some things you meant to do—but summer weather let you forget about heating problems? Was anything ever done about the machine shop foreman's continual complaint that the place was cold and drafty? How about that slight leak at the unit heater in the shipping room?

Why not go on a safari right now and hunt out the parasites that are gobbling up both your fuel and man-hour dollars?

Let's start with boilers. Soot deposits not only boost fireside corrosion rate, but team up with scale on the waterside to form an insulating blanket. If this blanket thickens to the point where most of the heat energy transfers from fuel to just the boiler metal instead of getting through to the water, you may be in the market for new boilers. At the very least, you'll be your fuel supplier's best customer.

Take enough time to thoroughly clean waterside and fireside including the breeching. If furnace refractory is in poor shape, repair or replace it. Make sure the chimney is clear. A choked stack could mean destructive over-pressure in the furnace.

The safety valve is the most important control on your boiler. Test it with the hand lever. If it shows any tendency to stick shut, remove it from the boiler and overhaul it. If it refuses to work *perfectly*, get a new valve.

Almost equally important is your low-water fuel cutoff. If it's a submerged (probe) type, check its waterside condition. (Remember, faulty or missing probes mean *low water* to the control. Using a jumper wire, or blocking the relay in the closed position isn't the answer to this one). If it's a float type, dismantle it enough to prove it's in good shape. Clean and lubricate the linkage. Clean the float chamber. Make sure piping connections to the boiler are not obstructed. With either type control, check the electrical cir-

losses — Now!

By R C BELLAS, *Assistant Editor*

cuit for physical condition. Test by simulating a low-water condition.

If you've got a steam system, clean or replace dirty, discolored water-gage glasses, be sure packing is serviceable. If you haven't got cross-tee fittings at all right angle turns in the water-column piping—you should have. By removing plugs from these fittings it's a simple matter to clean and inspect the piping. A false water level isn't fair to your or to your boilers.

Check fittings and valves on the boilers including main stops (if you have them) in the flow and return piping. Look for evidence of defective stem packing. Remove and test pressure, or combination, gages. If you don't have facilities for this, ask your boiler inpector to test them. He'll be glad to do it.

Firing equipment is next on the check-list. With stokers, your best bet is to follow manufacturer's recommendations for overhaul. Burned or damaged grate bars, drive assembly or other parts means trouble sooner or later. Replace them now. Clean the stoker, give it a test run. Have enough shear pins on hand to last through the winter.

With oil firing, clean and inspect the burners. Check light-off and loss-of-flame controls. Check the fuel lines and strainers all the way back to the supply tank. If the tank is nearly empty, now is a good time to drain and clean it to get rid of sludge and sediment. You will get much better burner performance and it will take a big load off your strainers.

Gas firing doesn't eliminate need for burner inspection and cleaning. Make sure air and gas passages are clear. Test each burner. Check automatic controls and wiring. Inspect gas valves and piping up to and including meter.

Now let's turn to the flow piping. Its condition is a big factor in whether you get a high or low return for your fuel dollar. With hot-water systems, air leaks rob you of heat, cost man-hours to bleed and drain radiators, expansion tanks. With steam systems, faulty traps set up expensive "short circuits." Start at the boiler and go over every foot of flow piping. Check insulation, hangers, pipe pitch, radiators, convector, traps, vents.

Damaged or missing insulation will mean heat loss. In correcting this, check the cause. Carelessness in handling stock, bumping piping with hand trucks, men climbing over piping instead of using ladders, can make you face the same problem next year.

If you've got unit heaters, get up close and look them over. Operate the fan motor. Check fan blade and heater coils for dirt. Check the control thermostat contacts and setting.

Follow return piping back to the boiler. Be suspicious of buried sections. With automatic boiler feed, it's possible to lose a lot of water, and fuel dollars, through these out-of-sight, out-of-mind runs of piping.

Inspect expansion tanks, circulating pumps, vacuum pumps. These components can be real headaches when you need them most. Look over pump controls for worn contacts, faulty switches, wrong size or blown fuses.

Last, but not least, how about your supply of spare traps, valves, fittings, etc? They're a lot easier to get, and you might save some money, by ordering them in quantity right now.

With an inspection safari like this under your belt, you'll find yourself out of the woods and on the road to trouble-free heating all winter long.

CORRECTION:

Line 11, right-hand column, p 122, August POWER, should read *expansion-valve*, rather than *expulsion-valve*. True, we fluffed the proofreading on this, but we'd just been reviewing a "How To" story on the handling of after dinner speakers.

SAFETY

CLOSED SPRINKLER VALVE plus delayed alarm let this foundry fire get out of hand

Automatic sprinklers are 96% effective in putting out fires. When they fail it's largely because of human neglect. Now is the time to check:

Does your automatic sprinkler

► AUTOMATIC SPRINKLER SYSTEMS undoubtedly are the greatest single contribution ever made to fire protection. They attack a fire in its early stages and either extinguish it or hold it in check by discharging about 30 gpm of water from each sprinkler head.

But human failure sometimes causes unsatisfactory performance. According to National Fire Protection Association records of nearly 59,000 fires in sprinkler-equipped buildings reported from 1925 to 1954, the sprinklers did not perform satisfactorily in 2255 instances, see chart, p 119. In 808 of these cases water was shut off.

Other important avoidable causes of sprinkler failure are inadequate water supply, obstructions, defective valves, frozen systems. Careful inspection and maintenance can cut down these causes of failure.

General rule, is to have plant personnel inspect sprinkler systems weekly. This can well be supplemented by regular professional examinations by your fire insurance company, by sprinkler equipment manufacturers' inspection service or by central-station supervisory service, if available.

Central-station supervision is arranged so that whenever water flows in the system, detection devices automatically send an alarm through the central station to the municipal fire department or other protective organization. The supervision system can also detect shut-off valves, inadequate water level in gravity tanks, dangerously low water temperature, high or low air or steam pressure, electric power failure.

Weekly inspections, especially in plants without central-station supervision, will disclose valves that were not reopened after repairs or were closed by unauthorized men. Below are maintenance details for ordinary wet or dry pipe systems suggested by National Board of Fire Underwriters.

Control valves. Examine all control valves regularly, at least once every week. Number the valves and put up signs indicating what portion of the system each controls. Weekly inspection report should show that valves are (1) open or closed (2) properly secured or sealed (3) in good operative condition, turn easily, do not leak (4) readily accessible and (5) that wrenches are in place.

Gages. Read air- and water-pressure gages weekly while inspecting control valves. See that pressure is normal.

Flow tests. In cooperation with the inspection department having jurisdiction, make regular water-flow tests from test pipes at the top of the systems and at the main drain valves. Note pressure-gage readings with the drain valve wide open and again while closed. If readings vary materially from normal, find out why. These tests show whether normal water supply is available and indicate possible closed valves or other obstructions.

Alterations and repairs. Notify the plant manager before closing a sprinkler valve to shut off any part of the system. Emergency connections may often be made when the normal water supply must be interrupted. Afterwards, make a special inspection to insure open and properly-secured valves.

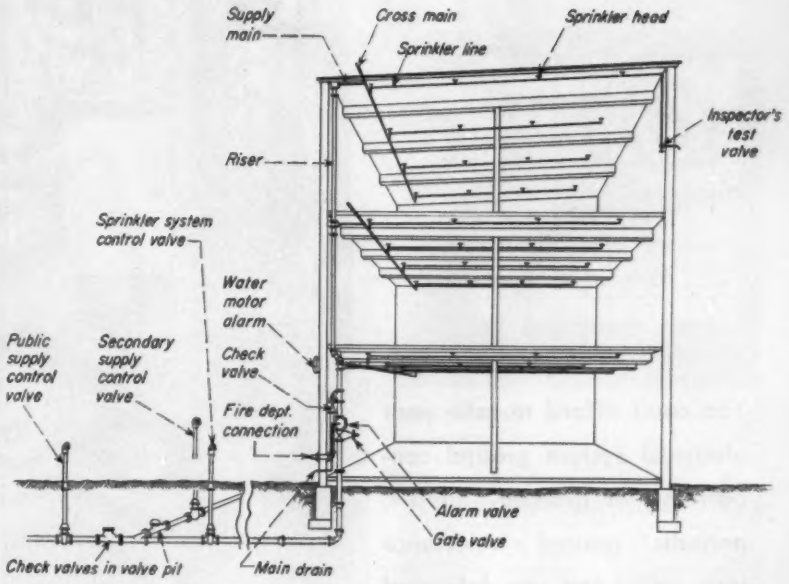
Changes in type of work or the fire hazard in an area may require sprinkler-system alterations. These may include changing sprinkler location and temperature rating, protection against corrosion, loading and mechanical injury. Changes in heating, lighting or mechanical equipment may also require sprinkler-system modifications. Usually, dry pipe systems are installed where temperatures may fall below freezing. Additional protection may also be required because of changes outside the protected building that might affect the spread of fire toward it.

Sprinklers. See that sprinklers are (1) in good condition (2) clean (3) free from corrosion or loading with dust or

Causes of unsatisfactory sprinkler performance

Water supplies shut off	808
Occupancy hazard too severe	288
Inadequate water supply	205
Obstruction to distribution	201
Inadequate maintenance	184
Partial protection	167
Faulty building construction	139
Antiquated system	62
Slow operation	48
Miscellaneous and unknown	42
Exposure fire	43
Defective dry pipe valve	42
System frozen	26
TOTAL	2255

CARELESSNESS or negligence account for most of trouble in these 2255 fires



TYPICAL wet-pipe sprinkler system connected to city water main. Piping is filled with water under pressure; it must be protected against freezing temperatures

system really protect your plant?

foreign material (4) not painted or whitewashed (5) not bent or damaged (6) of the proper temperature rating. Always keep enough extra sprinklers on hand.

Piping. Keep piping in good condition, free from mechanical injury. Don't use it for supporting ladders, stock or other material. Provide special protection in corrosive atmospheres. If necessary, have experienced men or contractors clean or flush out all or part of the piping. Keep hangers in good repair. Promptly replace broken ones and refasten any that become loose.

Dry-pipe valves. Check air pressure on each dry-pipe system at least once a week and pump up when necessary. If pressure drops rapidly, find and repair the leaks. Keep dry pipe free from moisture. Maintain priming water at the proper level above the dry-pipe valve. Heat the valve closet in cold weather; see that heating equipment is safe. Slight freezing of a dry-pipe valve may make it inoperative. Before and during freezing weather, make sure that all low-point drains of the dry-pipe system are free of water. Thoroughly clean, service and reset each dry-pipe valve once each year during warm weather.

Water flow alarms. Test water-flow alarms regularly by opening the inspector's test pipe or by-pass test connection. Check electric alarms weekly, using the test switch or contact. Keep the small valve or cocks controlling the water supply to alarm devices secured in the open position.

Don't test water motor gongs in cold weather if piping to the gong may freeze. (*Continued on page* 182)

Prepare now for winter

ONCE A YEAR, in October or at the approach of freezing weather, make a special inspection of each building, its sprinkler system and water supply.

Are control valves open and properly secured? Are post indicator valves properly oiled? Do they turn easily? No leakage around the stem?

Close cold-weather valves. Drain exposed pipes. Leave these drain valves slightly open. Check dry-pipe valves to make sure the systems are holding air properly and that electric and water motor alarms are in order. Are drains at low points of the dry piping properly clear of water? Check dry valve heating provisions. Are they adequate?

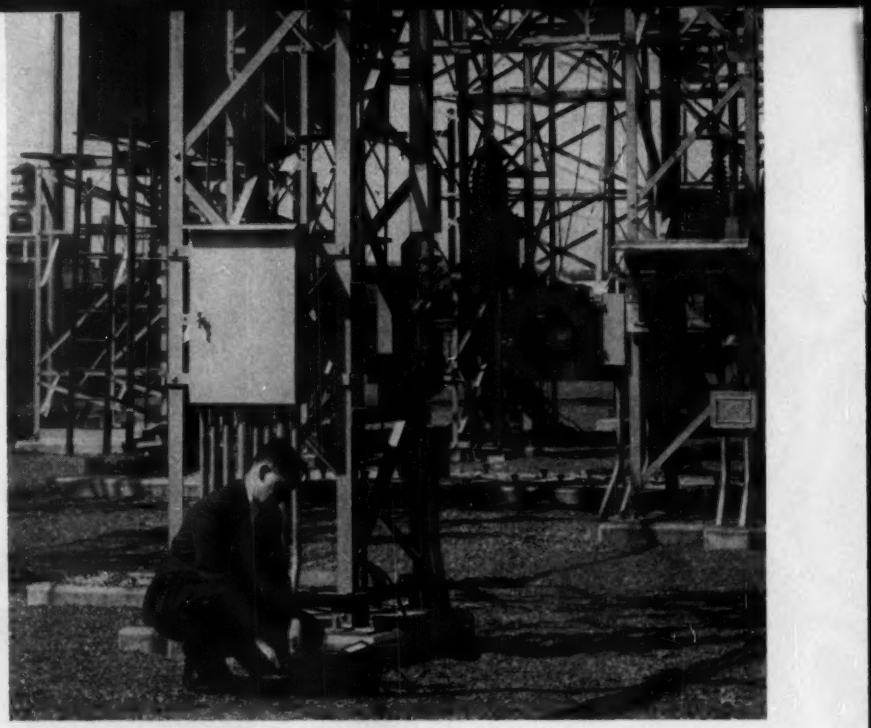
Test alarm valves. Properly secure valves or cocks controlling the alarm devices.

Check gravity tank and its protection against freezing. Does heating system operate satisfactorily?

Are fire pump rooms in proper condition? Check intake and suction reservoir. Are they free from mud, gravel?

Check building components. Are windows, skylights, doors, ventilators, etc in proper condition? See that cold air will not enter nor unduly expose sprinkler piping to freezing. Is heating equipment ready for winter service, especially in idle or vacant portions of the plant? Arrange for adequate heat in extreme weather, at night, on Sundays and holidays. Points specially subject to freezing are blind or unused attics, stair towers, low spaces under the buildings, and small roof houses.

You can't afford to take your electrical system ground connections for granted. Simple, periodic ground - resistance tests will keep you informed about . . .



MAKING GROUND-RESISTANCE MEASUREMENTS with ground tester. Instrument leads are attached to permanent ground connection and to two reference ground rods

How good are your system grounds?

► THE GROUND CONNECTIONS on an industrial plant's electrical system usually don't get much attention until there is trouble. Then you may find out they don't do the job they are supposed to do. The *ground* of an electric distribution system is intended to provide a return path to carry fault current back to the transformer or generator that supplies the system. Ground actually behaves like a conductor with definite resistance, and, if resistance is too high, it won't carry required current. Ground in an industrial plant is made up of two circuits. One is through the metallic circuit of conduit, pipes, structural steel, machinery, ground straps and possibly ground-network cables. The other circuit is the earth itself. Fault current may follow a very complicated path through both of these circuits. The important thing is to have ample current carrying capacity. Ground-fault current can be expected to equal phase-to-phase short-circuit current and can be much larger. Where lightning must be considered, as with stacks, tanks and electrical distribution towers, ground connections for lightning arrestors must be capable of carrying large currents away to earth.

It takes two kinds of ground connections to ground a system, the *neutral ground* directly connected to transformer or generator supplying the system, and the *equipment ground*. The latter may be made to earth in several places, care being taken that all equipment capable of conducting electricity, whether electric equipment or not, has a reliable connection to other equipment or structure directly connected to ground. Neutral ground sometimes has a resistor or reactor inserted between neutral point of transformer or generator and the actual connection to earth in order to limit fault current. Actual connection to earth, however, should have a resistance as low as when neutral is solidly grounded.

When ground resistance is too high the advantages of a grounded system are lost. These troubles can result:

1. If ground fault occurs, there's voltage drop to ground, and ground is no longer at zero potential with respect to metal equipment, structure, etc. There's danger to personnel.

2. One very important reason for grounding neutral is to quickly remove faulted equipment from line. If fault current is limited by resistance, relays may operate slowly or not at all. This is especially important where motors draw several hundred amperes during normal operation.

3. Damage to faulted equipment will be greater if equipment is not quickly disconnected. When insulation fails in motor or transformer, first damage is often restricted to copper windings. But if arcing is permitted to continue the iron core may be seriously damaged, making repairs expensive or impossible.

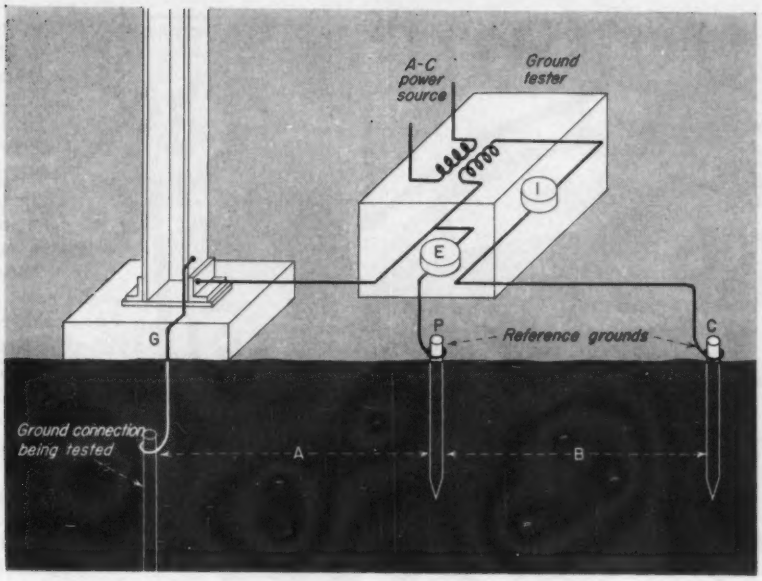
4. High-transient voltage can build up under certain circumstances.

5. In some plants static electricity can become a serious hazard, endangering personnel by shocks, or igniting explosions and fires by sparks.

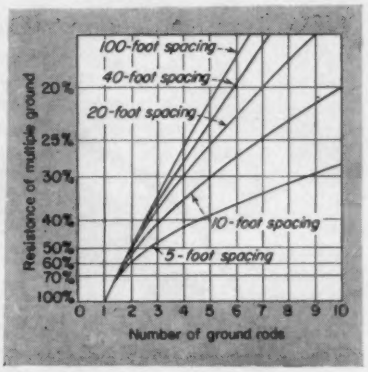
6. Lightning protection is impaired, with danger of high induced voltages and direct strokes.

7. Communication and process control systems dependent on a good ground can become unreliable.

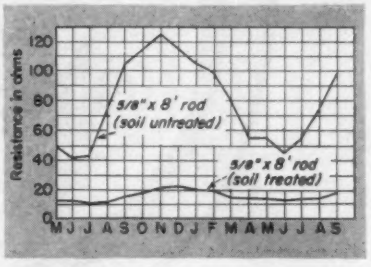
Keep out of trouble by making ground testing and inspection part of your regular maintenance schedule. Most im-



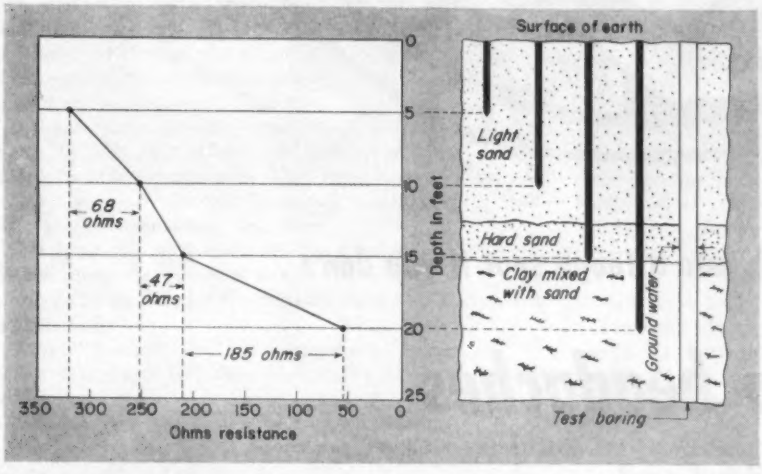
FALL-OF-POTENTIAL ground-resistance measurement uses ammeter, voltmeter and ac power source, or self-contained automatically-compensated ground tester



MULTIPLE-ROD ground connections cut resistance. Rod spacing is factor too



CHEMICAL TREATMENT of soil reduces seasonal variation in ground resistance



DEEP GROUND RODS have less resistance than short ones. They're more reliable since deep soil is less likely to dry out. Nature of soil layers affects resistance

portant step is resistance measurement of connection to earth. Test can be made with an ammeter and voltmeter, but it's a complicated job. It's easy and trustworthy if done with a ground-resistance tester. Several makes are on the market, and one of these units is a good investment for a large plant. Smaller plants can have tests made occasionally by an outside engineer or electrical contractor. Resistance of metallic ground circuit through conduit, structure, etc, should also be measured. This can be done with an ohmmeter or by the voltmeter-ammeter method if you don't have a ground-resistance tester. Ground straps, clamps and cables should be inspected to make sure they are large enough and in good condition, not broken or corroded.

Ground testing has become more important in the last few years for a number of reasons. First, most plants have expanded with the result that ground-fault current will be larger. Second, non-metallic pipes and conduit are widely used, making underground-pipe systems much less dependable as ground connections. Third, in many parts of the United States the water table has fallen appreciably in the last few years due to decreased rainfall. Many underground-piping systems which were effective grounds for many years are now in dry, high-resistance earth. This, according to engineers of the James G Biddle Co, manufacturer of ground-testing equipment, is making many plants "ground-conscious" for the first time. And of course there is always that old enemy corrosion. If grounds are not checked occasionally, even very good connections can disappear in a few years.

What is the correct ground resistance? Zero is desirable but is not usually economically feasible. National Electric Code specifies not more than 25 ohms. Most insurance companies try to get a 5-ohm limit. Even lower values are standard in specialized industries. Chemical plants often will not permit more than 3 ohms for motor grounds and 0.5 ohm for substation ground-connection resistance.

Several methods are available to measure ground-connection resistance. Of these, the fall-of-potential test is most practical and reliable. It's best

(*Continued on page* 190)

You're only putting yourself into a tough spot if you don't . . .

Prevent pump headaches

By **CHET R McFARLAND,** *De Laval Steam Turbine Co*

Sure, running a complicated plant isn't always easy. But how about those breakdowns that come up time after time? Are you doing your share to head them off before they happen?

► WHEN SALES ENGINEERS and service men shoot the breeze it's usually about machinery they sell or old jobs and service problems they've run into. Yesterday we gathered around our only ash tray and got into such a bull session. Result was a discussion of three interesting case histories that highlight a common, but unnecessary headache.

Case No. 1. Years ago, we were trying to get our machinery established with a paper mill. One day I had a chance to help their chief engineer with a small pumping problem. It was a natural for one of our rotary pumps. Because we were a new supplier, I knew I had to work closely with him until his problem was solved. My boss gave me the green light so I made a trip to his plant.

Their firm made paper bags. The problem lay in getting glue to several glue machines in the paper mill. Girls would pass paper against a nozzle, flip a switch to start the glue, wet the tab on the paper, then fold the sheet to complete the bag. Glue line was only two inches in diameter. But there was about a thousand feet of this pipe zig-zagging through the plant. Friction drop was very high.

Biggest trouble was the morning start-up. During the night, glue would partially dry in the pipe, usually inside

the nozzles. And the old pump wasn't big enough to push that semi-coagulated glue through the nozzles. Once this fouling material was ejected, everything was OK again. The chief knew that a reciprocating pump would give the needed pressure, but he was afraid that pulsations would squirt glue out of the nozzle, and give the girls trouble.

I sold him one of our rotary pumps—a 6-gpm 1000-psi at 500-rpm unit. Paste was pumped at 196 F. Next time through my territory I stopped to check the installation. Everything was fine. The chief engineer said the pump had completely solved his problem.

However, a month later, the chief phoned. He said the pump had suddenly "gone to hell in a hand basket." Within an hour I was on my way to his plant. When I arrived, the chief and I started tearing that pump apart to find the gremlin. It didn't take long.

Bailing wire, wrapped around the pump's internal parts, had caused the rotors and inside of housing to be chewed up something awful. The chief removed the wire, wondering where it had come from.

Paste for the plant's gluing operation was made by dumping powdered glue into two 6-ft-diameter, 8-ft-high vats. These vats were steam heated and solvent was added to run the dry powder into a sticky paste. Supplier of the powdered glue had evidently gotten some bailing wire into one of the glue bags. When contents of that bag was dumped into the vat, the wire went with it, came out through the bottom outlet in the vat and caused all the trouble.

To prevent a recurrence of the condition, I suggested installing a wire screen over the glue tank. Dry glue could then be sifted through the screen into the vat—keeping out all foreign materials. After agreeing to do this, the chief ordered replacement parts from me.

The new parts got his pump going. Everything worked smoothly again. Fact is, the chief ordered another pump in order to double his operation. Then came a second accident.

This time a bolt got into the pump, wrecking it for good. His plant was completely shut down.

Shortly after, I ran into the chief at a technical conference. I asked about the pumps.

"Mac," he answered, "We replaced those two pumps with another make."

"Why?" I asked, very much surprised.

"We just didn't feel they were up to the job," was his answer.

"Did you ever screen that vat?" I asked.

"No," he answered, "I'll be truthful and admit we never did get around to that screen."

You readers figure this one out.

Case No. 2. One of our men popped up with a story that drove home the same point. We had installed a rotary pump down South to handle hydrogenated cottonseed oil. Unit handled about 250 gallons at 22 psi and ran at about 1750 rpm. Service was fairly easy; operating at 175 F, with viscosity only 15 centipoise.

Not long after installation, our man was called to check the unit. He opened the pump and found that internal parts were heavily scored. Two small wire screens, strong-backed by a perforated plate had been inserted at the pump's suction flange. But screens had been removed when perforated plates were pulled out of the lines. That let welding beads and scale into the pump.

When suction lines were opened, we found at least three pounds of welding beads and slag inside. Naturally, some of this material had gone through the pump, severely damaging it, so pressure couldn't hold. On all welded pipe, it's standard practice to put a strainer ahead of the equipment, whether a steam turbine or a pump. Reason is that, in welded pipelines, welding beads form on pipes inside. But once these beads are cleaned out of the system there's little to worry about. Trouble is it takes months of operation for all the loose beads to collect on a screen so that they can be removed.

Our serviceman took this up with the plant engineer at the time the piping and equipment were installed. But the engineer wouldn't install strainers. Now that equipment had failed, he wouldn't even replace the temporary screen in the line ahead of the pump, despite the evidence before him. That's another one for the books.

Case No. 3. Third member of our group came out with another experience. This concerned a pump sold to a food processor handling soy bean oil. Our customer had installed the rotary pump but it seized after only fifteen minutes of operation. The plant super called our salesman and raised Cain. Our factory shipped him replacement parts that same afternoon. Supposedly, the problem was solved.

New internal parts were installed, and the unit ran for exactly fifteen minutes—then seized again. This time our engineer called to personally look over the situation. To be on the safe side, he took another set of repair parts with him. Plant super met him at the door with a sheepish expression.

"I think I found our trouble," he said.

He brought out a wadded towel and opened it up. There was a handful of welding beads, scale, nuts and bits of wire. Here was another case where trouble could have been prevented by a screen placed ahead of the pump to catch foreign objects. Super was sincerely apologetic about the hard words he had used about our pump. So that afternoon he took our man out for a few beers.

So what? I've found the machinery game fun and very interesting. But you readers might remember one thing. This business isn't all design, special materials, power, control and versatility. Machinery's success or failure depends mostly on the human factor. You're putting yourself in a tough spot if you don't prevent these headaches.

Engineers design equipment and select the materials. Reputable manufacturers test their equipment before sending it to customers. But equipment still can't think, even though some modern machines come pretty close to it.

You can't always blame equipment when something goes wrong. In more cases than I care to admit, the source of trouble is due to some human failure during installation, operation or repairing. Let's watch this carefully.

Sure, but how about this angle? . . .

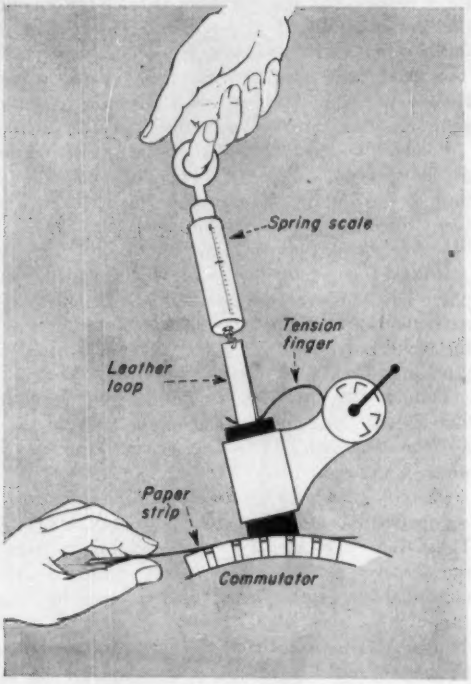
► I AGREE with everything Chet McFarland says about operators not protecting pumps and other machinery. But after working in various types of plants, I've got my own pet theories. I've found everything from wrenches to false teeth under duplex pump valves that had been in service for years. I've removed burlap, sticks, welding beads and even girl's panties from pumps aboard new ships during the war.

Since foreign material is such a common cause of trouble, why don't you pump manufacturers borrow an idea from other equipment builders? Strainers are a standard item, built right into their machinery. I've seen strainers in steam lines ahead of the turbine clog with welding beads and scale, but the turbine blades were unharmed. Why can't strainers be built into all pump suctions instead of depending on some contractor to put temporary strainers beween suction-line flanges? Seems silly to me to invest in an expensive pump, then have it damaged in the first few minutes of operation. If the buyer isn't aware of this common headache, why don't you fellows as a group protect him? Isn't that good business?—STEVE ELONKA, *Associate Editor*

Plant Electrical Fact File

NO 7: DC BRUSHES

6 pointers on dc brush maintenance



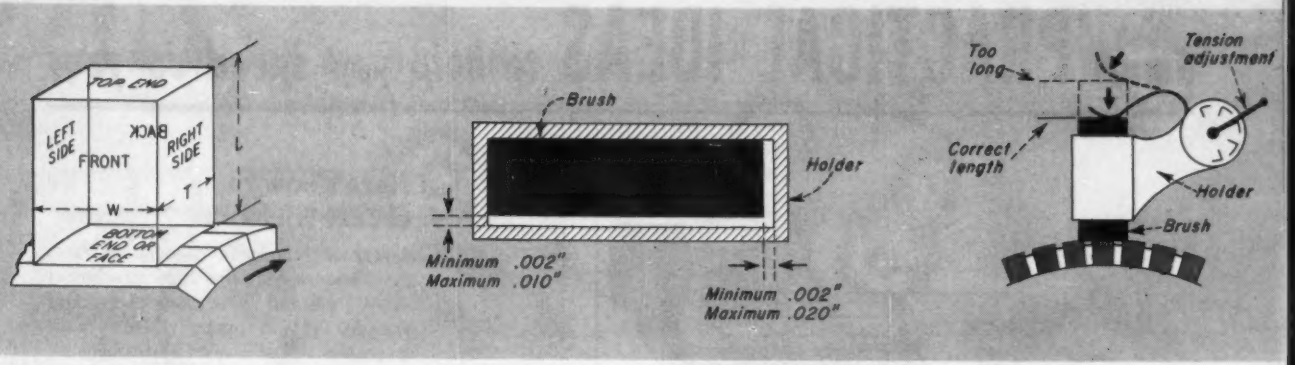
By **NORMAN PEACH**, *Assistant Editor*

DIRECT CURRENT MOTORS and generators are coming back into the plant in large numbers to meet speed-control demands of automation. This means that taking care of brushes is getting to be an important part of every maintenance man's job. It would take a book to cover the subject thoroughly, but here are six tips that will help to keep your direct current machines running smoothly. — *Prepared with assistance of National Carbon Company*

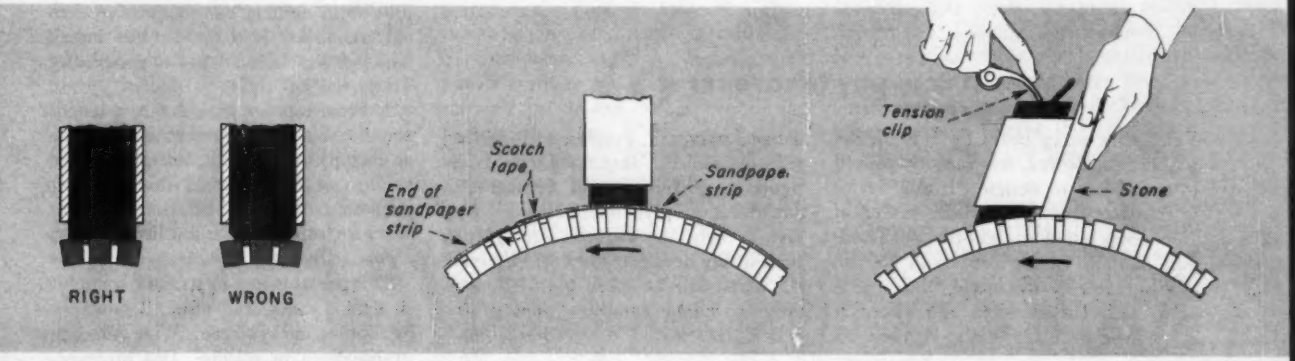
1 **CORRECT PRESSURE** for each grade of brush is supplied by the brush manufacturer. Adjust brushholder tension using small spring scale with leather loop that fits under tension finger where finger touches brush. Pull outward on spring-scale ring, keeping direction of pull parallel to length of brush. Read tension on scale to nearest ¼ lb at pressure that allows paper strip to come free when pulled gently. If necessary, move spring-adjustment lever to bring brush pressure within recommended range. Be sure you get equal pressure on all brushes or you'll be in serious trouble. Large brushes may be heavy enough to affect pressure. To get tension setting, subtract brush weight from proper pressure for brushes on top of commutator, add weight of brush for bottom brushes.

Brush	Application
CARBON. Practically pure carbon in its coke form.	Rough duty, especially on older motors and where mica is not undercut. Economical.
CARBON-GRAPHITE. Carbon and graphite mixed in different proportions.	Adding graphite makes brush softer, reduces brush friction, gives some cleaning action. Composition can be varied to fit job.
ELECTROGRAPHITIC. Carbon subjected to heat treatment to "graphitize" it.	Widely used with modern machines, especially at high speeds. Superior commutating ability.
GRAPHITE. Pure natural or manufactured graphite.	Widely used, particularly where cleaning action is desirable. Popular for fractional-horsepower motors.
METAL-GRAPHITE. Mixtures of graphite and metals.	High-current density applications such as low-voltage generators.

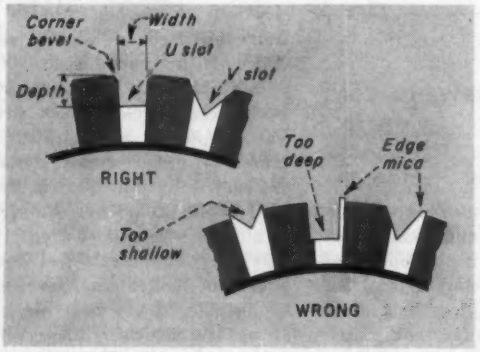
2 **RIGHT GRADE** of brush material is important for good commutation and long brush life. Choice of grade depends on current density, speed, if mica is undercut or not, whether cleaning action is needed, how much maintenance machine gets, whether atmosphere is clean or corrosive, etc. Consult brush manufacturer.



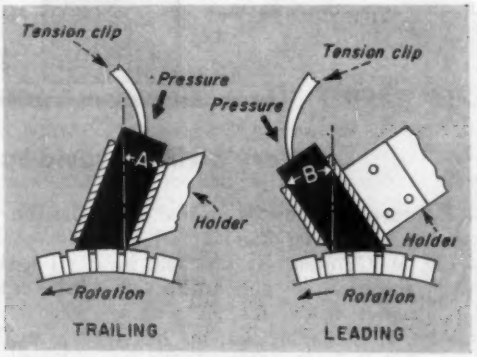
3 **PROPER SIZE** means a good fit in brush-holder box. The brush must be able to move up and down freely, but there mustn't be so much room that it can wobble from side to side. Tolerances are fairly close. Brush boxes must be kept clean, free from burrs, and replaced if burned or warped. Set brush holders close to commutator, following machine's specifications where available, to avoid wobble or wedging against one side of box. Brush-holder tension finger should be able to apply pressure parallel to the brush length



4 **CAREFUL SEATING** shapes brushes to commutator's contour. Avoid rounded edges that reduce contact area. One method uses a strip of sandpaper (never emery) as wide as commutator and as long as circumference. Fasten leading edge to commutator with scotch tape. Let trailing edge overlap a little. Turn armature in direction of rotation. Or, seat each brush group by holding sandpaper against commutator and sliding paper by hand. To seat with stone, hold it firmly, press down on the brush while machine is running.

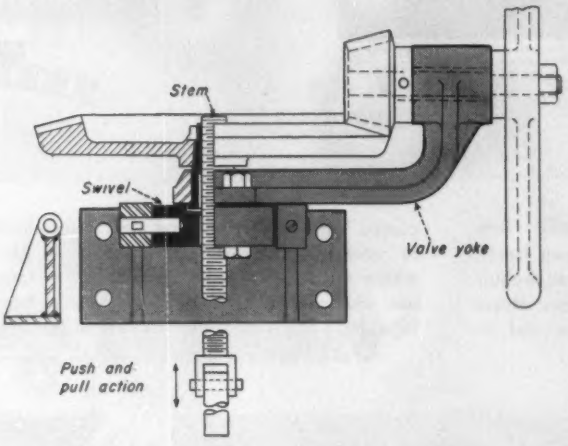


5 **PROPER UNDERCUTTING** prevents a lot of trouble. Job must be done carefully so no "edge mica" is left. V-slot is usually best, but requires more frequent undercutting than U-slot. U-slot must not be so deep that dirt collects and causes shorts. Edges of bars should be bevelled—inspect slots.



6 **CORRECT ANGLE** helps to keep brushes in position. You'll have trouble if brushes intended for right-angle mounting are as much as 4 or 5 degrees off. For trailing-mounted brushes angle A must not exceed 20 degrees. With leading-mounted brushes angle B lies in the area between 30 and 37½ deg.

Smart PRACTICAL IDEAS to help you speed up your

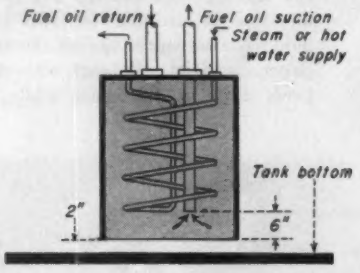


It does pay to save scrap

Value of a scrap heap, by T E Miller, p 131, Feb, POWER, was recently proved to me. I had to design a lifting device to translate a shaft's working motion of 75 degrees into a straight-line push-and-pull motion. Stroke; 16 in. at 250 lb.

We found a discarded 18-in. gate valve with outside stem and yoke. It was to be sold for scrap. I used its bonnet, stem, nut, gearing with bracket and handwheel, sketch. First, I designed a swivel to hold bracket and nut, then a plate-steel bracket with pins to hold the swivel. This gave a good lifting device at low cost. I'm sure old parts will be more useful if carefully evaluated before scrapping.

H W HAMM *York, Pa.*



Here's what I would have done

C F Bishop tells how he assured correct temperature for burning fuel oil, p 129, May POWER. He says that by having the return oil pipe drilled with 1-in.-diameter holes on 3-in. centers, bubbles, of oil flowing near the liquid level, dissipate at the surface.

This may be OK for solving his problem, but there's loss of heat from flashing oil as it leaves the pipe perforations. This heat escapes through tank's vent. My sketch of heater eliminates this problem. Design has inverted vessel or bell surrounding the heating element, with oil return and suction connections. It's a single heating coil.

If needed, you can use a double coil. Oil is heated as it's pumped from tank without transferring large amounts of heat to the main storage tank. Recirculated oil is returned to the bell through the connection as shown. Any vapor from flashing is confined to the inside of bell and transfers its latent heat to the surrounding liquid oil. Cost is reasonable. Hot oil is recirculated without vapor-binding or loss of heat.

H B WAYNE *Brooklyn, N. Y.*

Here's how to socket wire-rope

American Standards Association rates the zinc-socketed wire rope attachment as 90% efficient. The gimmick is: Did you do the job properly? Insurance inspectors tell of many failures because cable pulled out of socket. On passenger elevators such accidents kill.

Usually, cable isn't properly broomed out at end to get maximum contact area immersed in hot zinc. Nor is cable properly pickled to remove the last bit of grease, oil or rust. Wire must be absolutely clean to insure metal-to-metal contact. At times, sockets are filled with nothing more expensive than old plumbers' lead, or babbitt metal, both of which may prove dangerous. To do the job right:

1. From rope's end, measure a length equal to basket of socket. Serve cable at this point with not less than three seizings of No. 14 iron wire. Cut out fiber core of the cable. But don't cut out wire rope or strand when used as a core. Open up strands.

2. Separate wires in strands, straighten with a small iron pipe. Remove oil by dipping in kerosene. Wipe off each strand down to seizing. Dip broomed-out end into solution of one-half muriatic acid, one-half water. Stronger solution gives trouble. Corrosion sets in if you don't rinse completely. Hold wires in solution long enough to clean thoroughly. Visual check shows if all tarnish is removed. Rinse carefully under a hot-water stream. Wipe off. Then dry well by passing through a flame. Serve broomed end lightly so it slips into hole in socket's base.

3. Heat socket to insure good bond between zinc and socket metal. Cut out temporary seizing wire and distribute wire ends evenly about socket's interior so molten zinc is distributed well about each wire. Be sure socket is aligned with axis of rope. Place fire clay at socket base to seal in zinc.

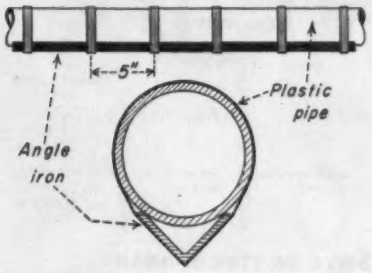
4. Pour molten zinc. Use only high-grade zinc. Don't heat above 830 F. If no thermometer, dip a pine sliver into the metal. When sliver scorches and bursts into flame, zinc is hot enough. Protect yourself with stout gloves and goggles when doing this job.

5. Don't cool too fast. After socket is cool, remove putty or fire clay from base. Then cut off the seizing.

P C ZIEMKE *Oak Ridge, Tenn.*

operation and maintenance jobs

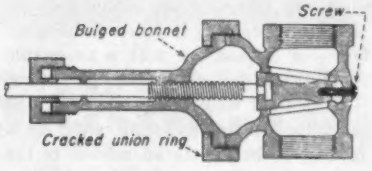
STEVE ELONKA, *Associate Editor*



Now, we use tape for plastic piping

Our plant uses a lot of polyethylene pipe. It is often strung around corners, over equipment, and so on. To make a neater and more rigid installation, we attach lengths of 1x1x¼-in. angle iron to the bottom of pipe, using a pressure-sensitive tape for binding, sketch. Angle is first bent in iron bender to curvature needed, then mounted on wall brackets or ceiling hangers. Pipe is then laid on angle iron and bound with tape. Result is a neat, strong, safe installation that's practical.

A D NORDSTROM *Edmonton, Can.*

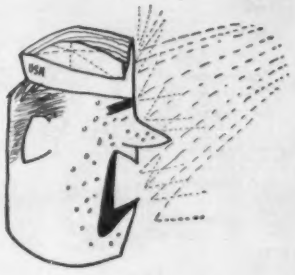


Smart valve repair

Water float trap on our 6-in. 100-psi compressed-air header failed to operate. Trap line filled with water and froze. Freeze damaged a 2-in. brass gate valve by bulging the bonnet and cracking union ring. Since we needed compressed air for process, our problem was to replace the bonnet and ring safely without a shutdown.

We made a clamp to hold the bonnet securely in place while gate was being closed. A hole was drilled through the valve body into the valve gate. We tapped the hole for a ¼-in. screw, sketch. Gate was then screwed to valve body. Damaged bonnet and union ring were replaced. Bolt was removed, sawed off so it would not extend into gate, and then screwed into body to close the hole. It worked swell.

F C BUTCHER *Grifton, N. C.*



What would you have done?

On an old 4-stacker destroyer, the condenser's main injection valve was removed in dry dock for inspection, then replaced. Inspector must have had his mind on some cute blond because after our ship got to sea, the main injection couldn't be closed. The boiler was salting up from a perforated tube. Only thing to do was open the condenser, plug the faulty tube.

If the main injection and overboard valves could be closed, we'd have had no problem. Overboard valve closed OK, but not the injection valve on ship's side. Only solution was placing a collision mat over the ship's side to cover the injection opening down in the water near the bilge keel. This opening was about 18 inches in diameter.

Mat is a large 6-foot-square canvas sheet, thrummed on one side with rope yarn like a fuzzy blanket, with heavy bull rope sewed around its edge. It lies in a diamond shape over the hull opening. The lower corner is pulled tight by a hogging line around the ship's bottom. Corner diagonally opposite is held by a suspension line, secured to some convenient deck fitting above. Corner toward the bow has a forward guy line and the after corner an after guy line.

Mat is good enough to stop most of flow, but it's tricky to keep tight. I've used a large piece of canvas for similar jobs, reinforced in various ways. With injection opening covered by mat, we drained condenser and opened the valve. We found a block of wood between the valve disk and seat. After plugging faulty condenser tube, closing up valve and condenser, we got under way on both turbines. What would *you* have done?

H M NEHAUS *Philadelphia, Pa.*

Your answer, Mr Warner?

In March POWER, p 140, W B Warner welded a piece of split pipe over the turbine joint. That stopped steam leaks on old turbine joints. Evidently the joints were pretty bad or there would have been no leakage.

All turbine casing bolts have clearance between the bolt and bolt hole except the dowell bolts. Nuts are not ground to seal the casing. Then what prevents the steam from leaking around the casing bolts? Bill Warner's valve-seat seal is a good one and I have used it. But I can't agree with his turbine-casing seal. How about asking him how he solved leakage around the bolts?

J H WOODWARD *Little Rock, Ark.*

Here it is, Mr Woodward

Woodward is right about casing bolts having clearance around them. This is true to some degree and may at times provide a leakage path for the steam, as he points out.

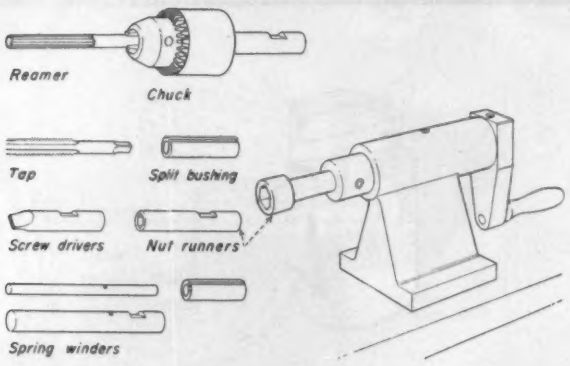
We overcome this leakage problem in several ways: A leak-off pipe is connected from the welded-on envelope to a low-pressure zone (generally to the turbine exhaust). This is usually effective. But if not, try any of the following: (1) Place copper washers under nuts to form a gasket to prevent leakage. (2) Seal-weld nuts to casing. (3) Weld cap over nut to casing.

W B WARNER *New York, N. Y.*

Turn page for more Practical Ideas ►

More PRACTICAL IDEAS

Begins on page 126

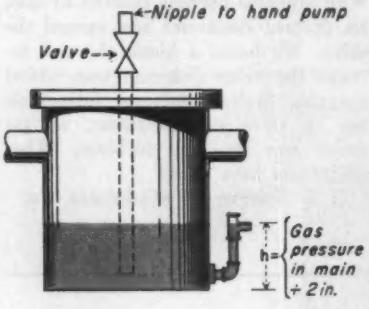


Here's a mighty handy homemade bench, crank tool

Sketches show bench tools that do many jobs. They're right for fast assembly of nuts, screws, hand tapping, small spring winding, etc. You'll find they save time where a hand power tool doesn't work well. Make attachments of screwdrivers, socket wrenches, spring winding arbors, tap holding split-bushings, etc, in sizes and lengths you need. Several of these fixtures are in constant use for our shop and production work.

C H WILLEY *Concord, N. H.*

Draining catch pots on gas mains automatically

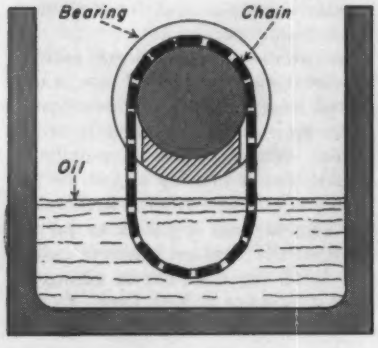


Condensate from catch pots on the mains is often drained by pumping out with semi-rotary hand pumps. This is tedious when there are a number of big catch pots. Piping shown insures automatic drainage.

Here we take advantage of gas pressure to force drainage collected in pots out of system. By using formulae shown, your pots will always be sealed.

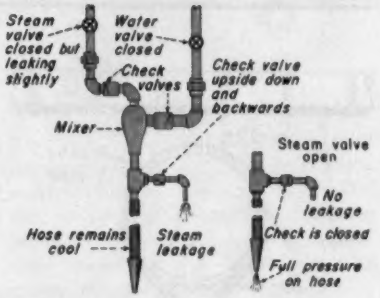
A RANGANNATHAN *Jabalpur, N. India*

Chain carries more oil than smooth oil ring



Oil rings are fairly dependable for lifting oil to top of shaft so it can work down through oil grooves in bearing. At times rings fail to rotate. This might result from such difficulties as not being smooth enough, being out of round. A slight flat on ring's inside or foreign matter under the ring can also cause lubrication failure. Unless detected early the bearing may be lost. We had such a problem on an important motor-generator set's bearing. We solved it by replacing ring with chain.

P C ZIEMKE *Oak Ridge, Tenn.*



Save on steam-hose repairs, replacement

If you're having trouble with operators who won't or can't (wet hands, etc) shut off valves tight on steam hoses, do this: Place a tee between the water heater and steam hose, then attach a 3/8-in check valve as shown. Mount check valve upside down and backwards.

In operation, valve flops open by gravity when pressure is off hose. If there's a slight leakage through throttling valve, steam flows out through small check valve, while the cooler condensate flows down the hose.

When steam or water is turned on, fluid's velocity forces the check valve to close. If check valve won't handle all the leakage, it's time to reseat the throttling valves. I use either a cheap check and discard it when it becomes faulty or a good one with a renewable composition disk that's easy to repair.

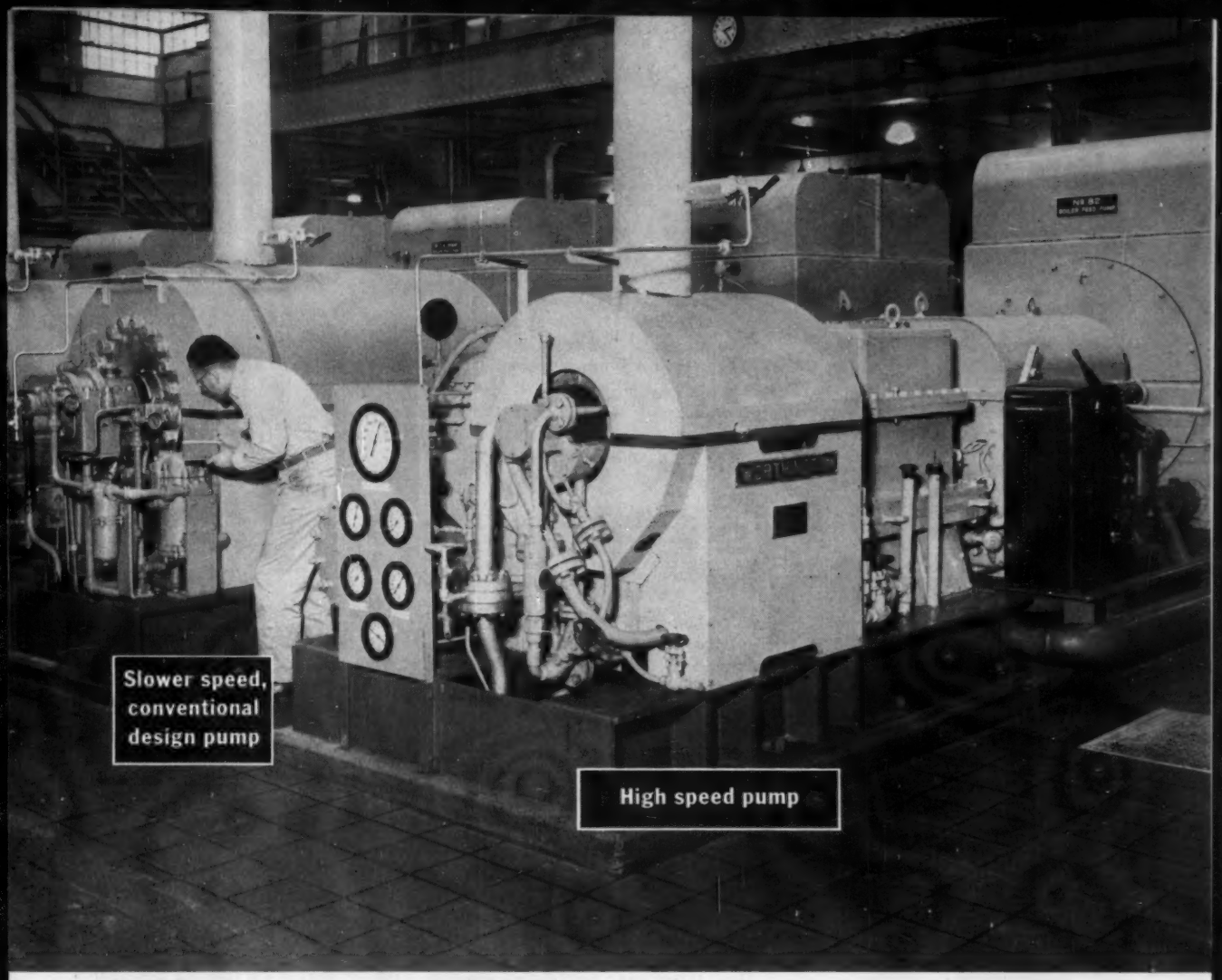
At present we're trying a new globe valve for severe throttling service. It appears to be OK as an answer to the high maintenance needed for ordinary plug or composition disk-valves for our service. Do readers have any ideas?

W G GIBSON *Vancouver, B. C.*

Now carbon brushes are OK

We had a 600-hp synchronous motor driving a 2000-cfm air compressor. One slip ring and brushes wore badly, in spite of changes in brush composition and tension, plus frequent sandpapering. We solved the problem by placing a double-pole double-throw switch in the motor pit. Wire was so arranged that polarity of current to brushes was reversed as position of switch was changed. Monthly switch changes completely eliminated the unequal wear. Answer: reversed polarity corrected the surface as fast as it got rough. This is an easy solution.

P C ZIEMKE *Oak Ridge, Tenn.*



6,000..8,000..10,000 rpm?

How much speed for modern boiler feed pumps?

With the trend towards superpressure power plants, a new look is being taken at existing boiler feed pump designs.

It's apparent that pressures as high as 5,000 psi cannot be reached economically at conventional speeds of 3,600 rpm without sacrificing reliability.

The 9,000 rpm Worthington pump above breaks through the speed barrier. Alongside a conventional unit with duplicate pressure and capacity ratings, its smaller size is dramatically evident. And this means greater reliability, lower costs. In operation since 1954, it has given satisfactory and reliable service in the new Kearny Generating Station of Public Service Electric and Gas Company, Kearny, N. J.

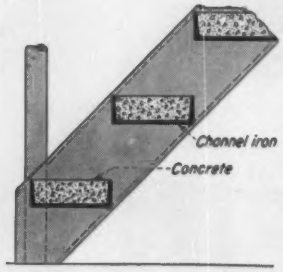
Twenty-two more Worthington high speed pumps on order. Speeds range from 6,500 to 9,000 rpm. If necessary, Worthington sees no reason why operating speeds shouldn't go even higher, without departing from experience-proved construction principles.

For more information, get in touch with your nearest Worthington District Office. If you'd like a copy of Bulletin RP-703, an interesting discussion of "High Speed Feed Pumps For Superpressures," write to Section C65, Worthington Corporation, Harrison, N. J. In Canada: Worthington (Canada) 1955, Ltd., Toronto, Ont. C-6.5

WORTHINGTON

More PRACTICAL IDEAS

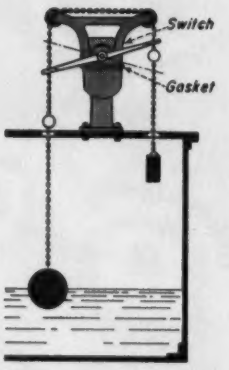
Begins on page 126



Safety steps

My sketch shows skidproof safety stairway that I saw in a local plant. This idea should be useful for other plants. After channel iron steps are welded in place horizontally, they are filled with concrete. All metal used in this stairway is of channel iron of various sizes. Steps are easy to keep repaired.

H W Hamm *York, Pa.*



Float switch for pump

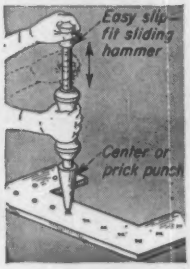
Sketch shows best little float switch ever exposed to the hard, grueling service of mine pumping. Cast-iron case is protected against ordinary infiltration of moisture by a rubber-gasketed joint. Balanced chain permits adjusting the stops for any reasonable spread of liquid levels.

Pulley support structure doesn't have to be removed for access to snap-action switch. By merely manipulating the balance arm, switch can be tested at will. Unlike float switches equipped with push rods that bind or bend in the sump deck openings to stall the motor, chains on this rig never stick if only a reasonable-sized opening is made in sump tank.

My experience is that floats are neglected because they are stuck down into some hole. Instead of buying the cheapest equipment, it pays to make installation that needs little care.

P C Ziemke *Oak Ridge, Tenn.*

Center punch has own hammer for speed



This shop-made tool will save time and patience if you have layout work to do. It's a prick punch with a sliding hammer. You can make an accurate layout because point is easily placed. Hold knob-top end with one hand and operate sliding hammer to drive the point. For heavy indentations, after layout, use your regular hammer and center punch to deepen original marks.

C H Willey *Penacook, N. H.*

Now, your old oil can holds touch-up brush

Don't throw away your old oil can that has lost the spring out of bottom. Make into air-tight pencil-type touch-up brush-holder container, sketch.

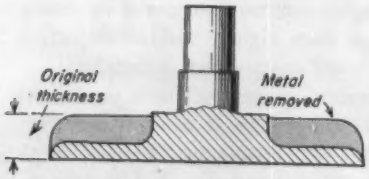
All you have to do is punch a hole into side of spout, then use screw to hold the wooden brush handle firmly in place. Then you won't lose the brush.

C H Willey *Penacook, N. H.*

Did you know . . .

That ready-mixed concentrated household starch works fine as a substitute in starch solution when testing for excess sulfate? It not only saves preparing a fresh solution every day or so but can be bought in your local store. Because household starch is concentrated you need only a few drops when making test. It's cheaper than prepared solutions. Buy at your grocer.

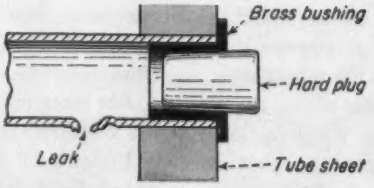
F R Rolston *Fredericton, N. B.*



Use old check valves . . .

as swing gates on low-pressure blower systems, for furnace television air, primary- or secondary-air systems for small boilers. Or use where a low-pressure check valve is needed if absolute tightness isn't important. Machine off the heavy disk as in sketch to cut down on pressure drop through the check. This is a few minutes' work.

G S Coblentz *Los Angeles, Calif.*



Leak stopper

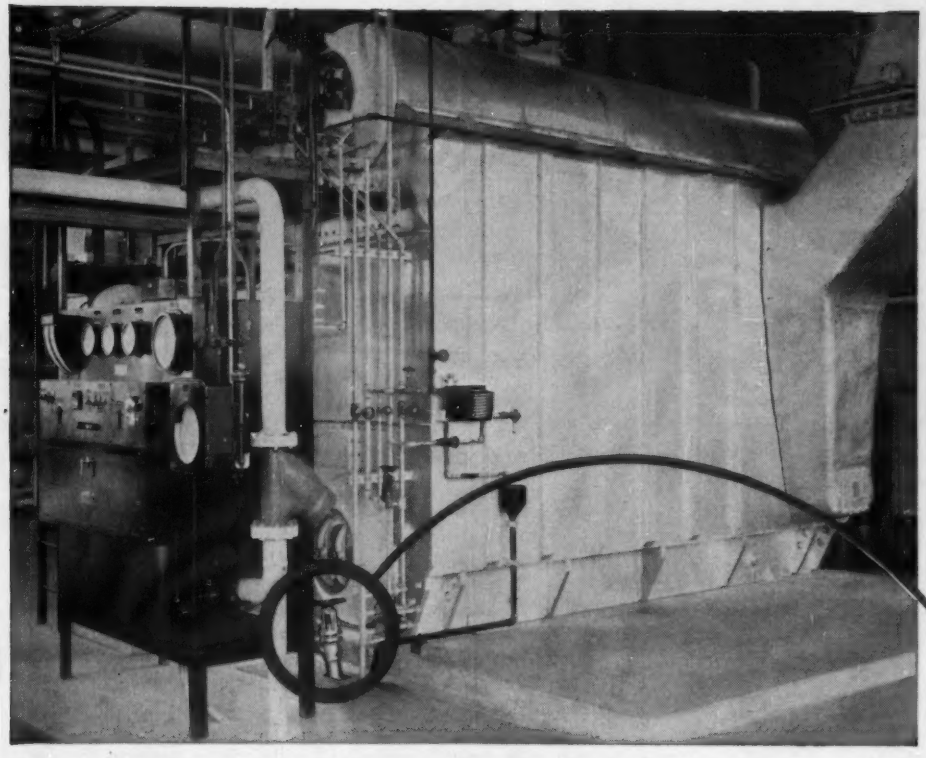
Differing in design from all tube plugs on market is plug and bushing shown.

To plug leaky heat-exchanger tubes, insert bushing in tube, then drive in plug. That expands bushing evenly, giving full surface contact between bushing and tube. Thus a tight seal is assured. Tube plugs are made for tubes 1¼-in. OD and smaller in size.

Courtesy, Lagonda Div, Elliott Co

My biggest boner

Please turn to page 188



COMBUSTION ENGINEERING ADOPTS YARWAY SEATLESS BLOW-OFF VALVES FOR PACKAGE BOILERS

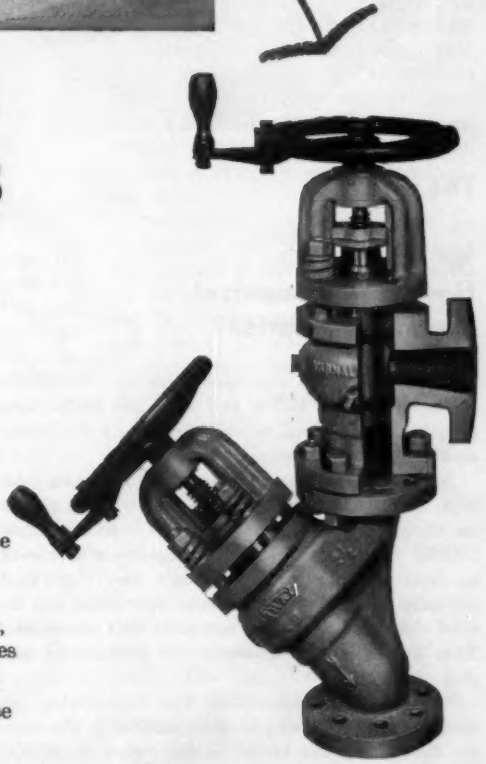
Combustion Engineering, Inc. on this package boiler installation at the Orangeburg Pipe Plant in California, again includes Yarway Seatless Blow-Off Valves as part of the "package."

It's a popular idea—and growing fast. All *good* package-type boiler installations are *better* when equipped with Yarway Seatless Blow-Off Valves.

More and more boilermakers are standardizing on Yarways, and more and more boiler users are expecting the advantages of Yarway Blow-Off Valves on their package units.

Get the full story on why more than 15,000 boiler plants use Yarway Blow-Off Valves, some for 30 to 40 years.

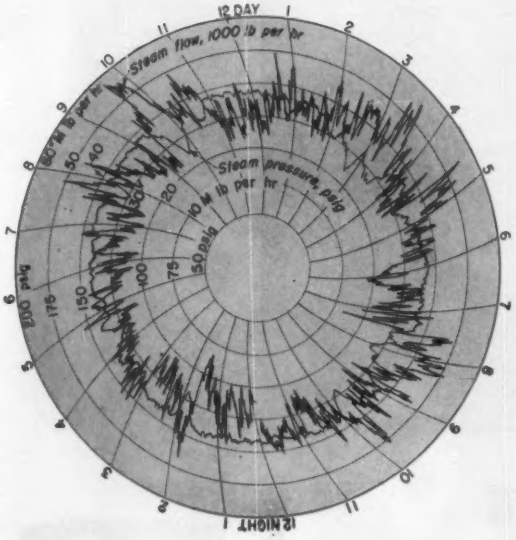
YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES



Yarway Type "B" Seatless Tandem Blow-Off Valve. Note balanced sliding plunger design with no seat to score, wear, clog or leak. Pressures to 400 psi.

YARWAY **BLOW-OFF VALVES**

Have a PLANT PROBLEM? Tap the



The question

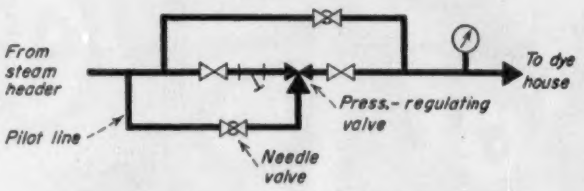
How can we control steam distribution?

My boiler plant is equipped with one 30,000-lb-per-hr watertube boiler and four hrt 84-in. firetube boilers. We sell process steam to a dye house as well as to other companies.

Normal main steam pressure is 140 psig. An 8-in. line feeds the dye house. Their load, shown on the chart above, goes suddenly from 15,000 to 50,000 lb per hr, causing main steam pressure to drop considerably. We aren't worrying about pressure drop in the dye-house operation, but do care about it for another company that we supply. They must have a constant steam pressure of 140 psig.

To rectify the condition, I'm considering installing an orifice or reducing section in the supply line to the dye house, to limit flow to 30,000 lb per hr. Will this solve my trouble? Are there better ways to do the job? I'd like readers' opinions.—*JCL, July, Power*

The answers



Here are three ways to do the job

Assuming that only the dye house has a widely fluctuating load and that the other companies have steady loads, there are three possible remedies for *JLC's* problem:

(1) Install an orifice or, preferably, a globe valve to act as an adjustable orifice. Disadvantage of this arrangement is that steam flow to the dye house is limited at all times—even when the other companies are pulling light loads.

(2) Install a pressure-regulating valve, sketch above, in the line to the dye house, hooked up to maintain a constant pressure upstream of the valve. This setup acts as an automatically variable orifice and will throttle steam to the dye house to hold constant header pressure. It will also limit steam to the dye house to prevent header pressure fluctuations, thus providing more steam than is possible with a manually-adjustable orifice.

(3) Install a steam accumulator in the line to the dye house, with an orificed line feeding the accumulator.

R Reis — *N. Plainfield, N. J.*

Sectionalize the steam header

One solution would be to sectionalize the main steam header. Let the 30,000-lb-per-hr boiler supply the swinging load on the dye house. Other boilers could supply the constant pressure load. However, the 30,000-lb-per-hr boiler is probably the most economical unit so it should be kept fully loaded, taking load swing with the other boilers.

Another method that would do the job: Install a constant-pressure regulating valve in the supply line to the dye house. It would maintain steam pressure in other customers' lines within acceptable limits.

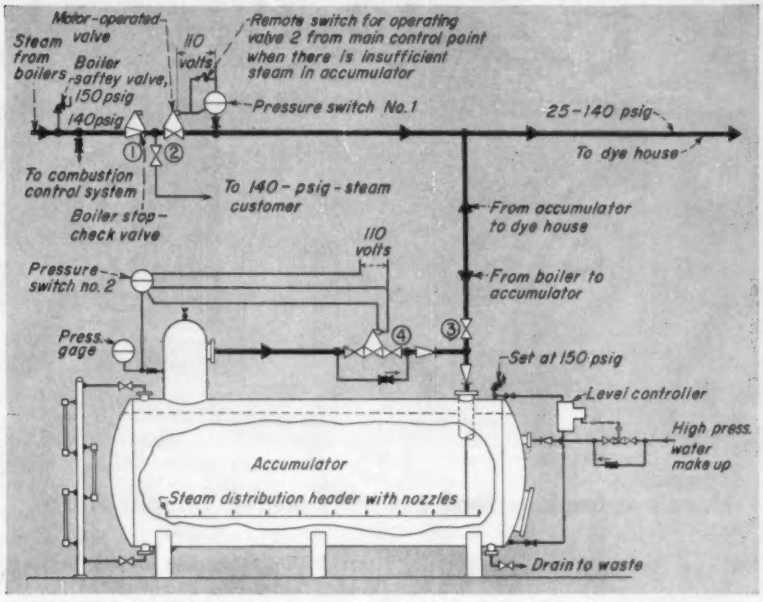
Good combustion control equipment would help maintain steam pressure within tolerances as well as improve efficiency, reduce amount of manual labor needed.

J H Woodward, *Superintendent* — *Cecil Lynch Station, Little Rock, Ark.*

Want help with your plant problems? Then send in your design and operating headaches to us. We'll give readers a whack at them.

know-how of over 45,000 Power readers

HOWARD KALLEN, *Associate Editor*



Try this accumulator arrangement

JLC should install an accumulator. It would increase the average efficiency of his present boilers by reducing fluctuations in steam demand. The dye-house operations, as shown by the recorder chart, vary from a low of 15,000 to a high of 55,000-lb-per-hr steam. The accumulator would absorb these load swings. And with proper valving and controls, constant pressure can be held in the line supplying the 140-psig customer.

The chart shows that maximum demands occur about six times between 7:45 am and 9:45 pm. Duration of these demands is between 15 and 25 minutes. An accumulator large enough to meet these conditions would simplify boiler operation substantially. Calculation of accumulator size is based on a minimum pressure of 25 psig for the dye house. The accumulator will then supply up to 35,000-lb-per-hr steam.

In the drawing above, valve No. 1, a boiler stop-check valve, is a boiler-code requirement. This, along with the boiler safety valve, is repeated at each boiler. Valve No. 2 is the automatic isolator when header pressure drops below 140 psig. Valve No. 3 isolates the accumulator for maintenance during seasonal periods of low steam demand.

Pressure switch No. 2 warns the operator that dye house pressure has dropped to the minimum. At this time the operator can either (1) alert the dye house to lower their steam demand or (2) open valve No. 2 slightly to pass a small amount of steam and to manually increase the firing rate. The operator should also watch closely for further pressure drop to protect the accumulator against vacuum conditions. Automatic protection against high vacuum in the tank is provided by valve No. 4 which closes when steam pressure drops to 10 psia.

When the maximum steam demand period has passed, or during those periods when steaming rate has climbed enough to restore the 140-psig, valve No. 2 will open and pass steam directly to the dye house. During this period the accumulator again becomes charged and ready for the next maximum demand period.

Installing the accumulator will result in about 10-13% saving in fuel. Also, the boilers and firing equipment will require less maintenance. And less manpower will be needed.

A J BREUGELMANS *New York, N. Y.*

Orifice, regulating valve or flow controller will work

My first solution would be to install a limiting orifice in the 8-in. line to the dye house. This orifice would be designed to produce critical flow and critical pressure drop at 30,000 lb per hr. Downstream steam pressure would then be 62 psig, with 140 psig on the inlet side.

Further reduction in downstream steam pressure would not appreciably increase steam flow. Thus, pressure drop across the orifice would increase until flow reached 30,000 lb per hr and downstream pressure 62 psig.

Second method: Install a regulating valve in the 8-in. line, with the control point (on the inlet side of the valve) set for slightly under 140 psig. As long as pressure on the inlet side is above the control point the valve stays wide open. It begins to close as soon as pressure drops below its set point. With this arrangement, the valve will attempt to hold 140 psig at the inlet, regardless of the cause of steam pressure drop.

Probably the best solution would be to connect the regulating valve to a flow controller that's designed to close the valve when flow exceeds 30,000 lb per hr. Below 30,000 lb per hr the valve would be wide open. It would gradually start closing to hold the flow at no greater than 30,000 lb per hr.

W L ECKDAHL
Republic Flow Meters Co, Chicago

Give dye house a demand penalty

Best solution to excessive demand rates of the dye house is to convince them that they must smooth out their peak loads. You may be able to show them how to reduce peaks by better scheduling and more efficient use of process equipment. Or, you may be able to impose a demand penalty rate added to the existing price of steam. This would undoubtedly cut down on unnecessary steam demand.

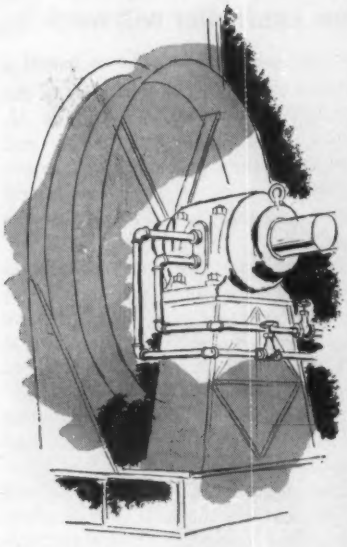
If your steam system permits, the dye house might be supplied by separately fired steam generators.

D R HETTELSATER, JR
Pittsburgh, Pa.

Turn page for info on cooling fan bearings ▶

More PLANT PROBLEMS

Begins on page 132



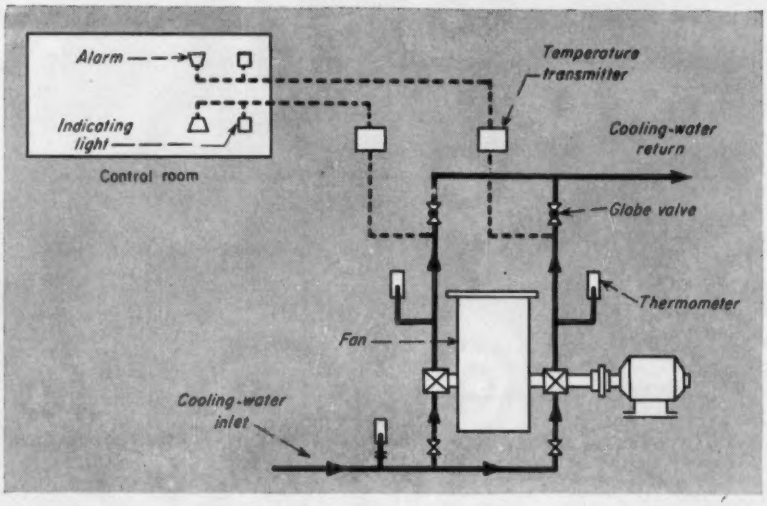
The question

What's best way to cool fan bearings?

For some time I have heard arguments on just how much cooling water should be kept on fan bearings, but have never come up with an answer that really satisfied me. Our fan shafts are 6-in. diameter. We have 18-in. bearings with two ½-in. water lines to keep the bearings cool.

Some operators like to keep water gushing out the drains, while others prefer the pencil-size stream. I'd like to know which method is best?—*JWB, July, Power*

The answers



Here's a hookup that controls water temperature

Required cooling water quantity for fan bearings depends on allowable bearing operating temperature and cooling-water temperature rise. These figures are usually specified by the fan manufacturer. For best performance, *JWB* should adhere to them.

The sketch above shows one type of cooling-water system employed for this service. Thermometers at each bearing cooling-water inlet and outlet tell operator the temperature rise. Cracking globe valves give manual control.

To avoid possible human error some designs also use a temperature sensing element that transmits a signal to the control room.

H B Wayne *Woodhaven, N. Y.*

Study operating conditions first

Reason why *JWB* has heard many opinions from operators on how much cooling water to use: They're giving him results of their own experiences. But whether he should use a pencil-size stream or a gush, no one can really say until they've studied *JWB's* conditions.

Bearing heating is caused by friction between shaft and bearing. This, in turn, depends on total bearing load and coefficient of friction. Also, at higher speeds, more energy is lost as heat.

Viscosity and lubricating characteristics of the oil set the best bearing operating temperature. These data will give *JWB* an approximation of the desirable cooling-water outlet temperature. Inlet water temperature is known. (It should be substantially higher than the oil's pour point.) Taking these factors into account we can come pretty close to the required water quantity by using the following formula:

$Q = PurN/1031(t_0 - t_1)$

where,

Q = water flow, gpm
P = bearing load, lbs
u = coefficient of friction
r = shaft radius, ft
N = shaft speed, rpm
t_0 = outlet water temperature, F
t_1 = inlet water temperature, F

A Di Lorenzo *Brooklyn, N. Y.*

JWB is tackling problem from the wrong end

JWB's concern should be not so much the quantity of water used, but the oil temperature. If heat transfer is good, he'll be able to use less water. But if it's poor, even large quantities of water may not suffice.

I recommend that he install a thermometer in the oil reservoir as a guide

(*Continued on page* 136)

Hall Industrial Water Report

VOLUME 4 OCTOBER 1956 NUMBER 5

Industrial Water, Pollution of Streams, Water Shortages—These are Serious Problems Confronting Industrial Areas Everywhere

Treating water for re-use, eliminating contaminants from streams, and engineering water in short supply are functions of chemical engineers skilled in water technology. Hall Laboratories is providing these services for industry at home and abroad.

England Was Not Merry England

Things were not so jolly for a large English factory when plans for expansion ran head-on into the fact that not enough suitable water was available for an enlarged power plant and increased process facilities.

The plant had two main water supplies. First-quality water from the city mains was limited in amount because of existing industrial and residential needs. The other supply was contaminated with sea water, decayed vegetation, sewage and synthetic detergents.

Hall Laboratories was engaged to conduct a plant-wide survey to assess all uses of water in the plant and to recommend means for reducing water consumption, improving and extending the use of the inferior quality water, and making condensate, treated and untreated water available for re-use. The primary concerns of Hall staff engineers H. A. Reda and Leonard Highley, Jr., were to limit use of the first-quality water so as to release a sufficient amount for the new high-pressure boilers, and to develop a better grade of process water.

The plant was using two million gallons of first-quality water and two million gallons of process water per day. Working from point to point through the plant with the cooperation of the plant staff, Highley and Reda were able to recommend a number of water saving changes. For example, about 150 drinking fountains were allowed to run constantly to keep the water cool. All this waste could be avoided with automatic coolers. Furthermore, it was concluded that city water was not required for cooling and process work and that an acceptable grade of process water, better than the second existing supply, could be provided by treatment of the effluent from a neighboring sewage disposal plant. Using this same treated water the plant could install a number of closed cooling systems, reducing requirements for cooling water by 90 percent.

Reda and Highley estimated that the conservation program will reduce the daily requirements for city water and for the new process water to one million gallons of each per day. The plant can now proceed with its plans for expansion. In addition, it is expected that the savings in water costs will pay off the investment for the changes in 4 to 5 years.

Water Tax Increased By Contaminated Effluent

When a steel products manufacturing plant near Cincinnati, Ohio, received a water tax bill more than 12 times the usual amount, they learned to their chagrin that their plant was contaminating an adjacent creek as well as discharging contaminated water to the city sanitary sewage system.

Work was started at once to eliminate the pollution. Some effective inplant changes were made, but these were not enough, since a subsequent analysis of the plant's effluent by the authorities revealed more suspended solids than tolerable in the cooling water being discharged to the creek.

A factual survey by J. H. Covode of Hall's Cincinnati office and H. A. Reda of the Pittsburgh staff established that suspended solids in the water from the plant's once-through cooling system were the only objectionable contaminant. As a result, part of these solids, originating from the dust collectors, were diverted temporarily to the municipal sanitary sewage system. When Reda and Covode pointed out that the water from the dust collectors could be clarified, studies were undertaken to compare the cost of doing this with the saving that would be realized from reduction of taxes for discharge of unpolluted water to the city sewage system.

Further study revealed that approximately 50 percent of the suspended solids carried by the cooling water came from precipitation of dissolved iron originating in the plant well water. Less but significant contamination occurred in the following ways. At the end of a melt, when the furnaces were tilted, cooling water was discharged directly to the dust-laden floor and into the open floor drains. This water then flowed into an open ditch located alongside the building. Roof drains also discharged into this ditch. The water then ran under a railroad culvert where dirt was shaken into it when trains passed overhead.

After plant management had put into effect all corrective changes, the authorities were satisfied and the tax was dropped to the normal rate for unpolluted water with a saving of more than $6000 per year.

Industrial Water Problems Require Special Handling

There are no "stock answers" to industrial water problems. For information write, wire or call Hall Laboratories, Inc., Hagan Building, Pittsburgh 30, Pa.

Water is your industry's most important raw material. Use it wisely.

Hall Laboratories, Inc.—Consultants on Procurement, Treatment, Use and Disposal of Industrial Water

for his operators to control cooling water flow. 130 to 150 F is usually accepted as a good operating range.

If load changes or variations in water temperature require too much attention, an automatic regulating valve can be installed in the supply line with a temperature-sensing element instead of a thermometer.

J H WOODWARD, *Superintendent*
Cecil Lynch Station, Little Rock

Avoid too much cooling water

Too much cooling water on a bearing can lead to serious trouble. Unless the bearing oil is picked for a low operating temperature, its viscosity will be too high for clearances in the bearings. Result is excessive bearing wear. In extreme cases the bearing will "wipe."

Cold bearings also tend to collect gum, dirt. This restricts grooves and may cut off oil supply to part of the bearing.

Valves should be opened periodically to flush out dirt that has collected.

R V LICHTENBERGER
Schenectady, N. Y.

Pencil-size stream does the best job

A pencil-size stream regulated so that the water outlet temperature is held at about 100 F, does the best job. And here's why: (1) A solid ½-in. stream wastes an excessive quantity of water. (2) Warm water keeps the oil less viscous and results in better lubrication of the bearing surfaces. (3) A warm running bearing eliminates the possibility of contaminating the oil due to moisture condensation on oil side of the bearing.

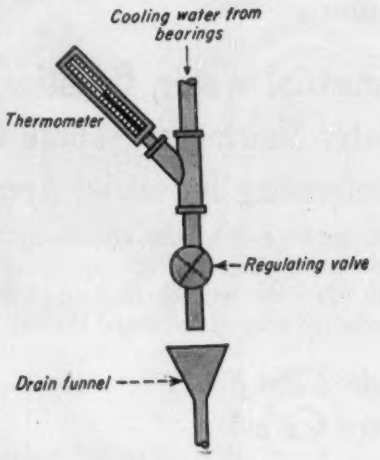
Overflow must be located at top of the bearing to insure that water floods it at all times. Be sure to run the drains to an open funnel so that they may be checked periodically.

L P ZICARI *Rochester, N. Y.*

Bearing should *feel* cool

Bearing should be cool to the touch. And, chances are, only a small quantity of cooling water is needed. A ¼-inch copper tube normally provides enough water.

J SCHNEIDER *Needham, Mass.*



Try this simple plan

Quantity of cooling water coming out of the drains should be only enough to maintain the desired bearing operating temperature.

The simple arrangement above will do the job. Inlet valve to the bearing is kept fully open. Flow is regulated on the drain side until required temperature is reached. 120 to 130 F is usually OK to do the job.

R F HAWKINS *Montreal, Canada*

Your October Problems

1 What's the best way to figure steam savings?

Our plant includes a medium-size boiler that supplies process and heating steam. In our monthly report we make a distinction between steam generated in the boiler and steam distributed to the plant. Steam distributed amounts to about 82% of the steam generated—the difference being used for boiler-room auxiliaries.

By making improvements we expect to save a certain amount of steam and we want to use a logical basis for computing this savings. Savings will be expressed in dollars per 1000 pounds of steam. We'd like to know whether it should be calculated on the basis of steam generated or steam distributed. This is important because the figure would be different for each method of calculation. And since the savings will be used to justify the investment, figuring it one way or another might mean the difference between approval and rejection.—*AWP*

2 Can we use one economizer with five boilers?

Sometime ago we installed two 70,000-lb-per-hr 600-psig boilers set for spreader-stoker firing. We ran them along with five old 115-psig units. 600-psig steam was used to drive a turbine-generator that exhausted into the 115-psig line. A parallel reducing valve balanced the load.

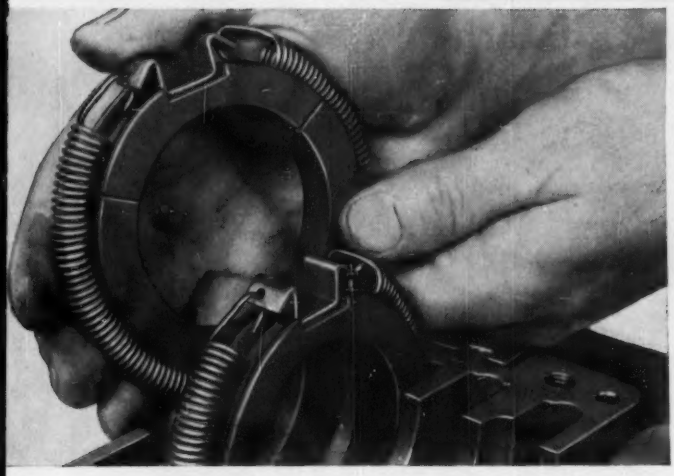
Now we are about to replace the five old boilers with five 40,000-lb-per-hr 600-psig units. Available space is limited. If we could use one economizer to serve all five boilers, space could be cut down substantially. Also, we want to keep flue-gas temperature above the dew point. Have *Power* readers advice or their own experiences to offer?—*EEC*

Sit down right now and answer one or both problems.

We'll pay extra for answers with photos or sketches.

On all General Electric High-speed Turbines,

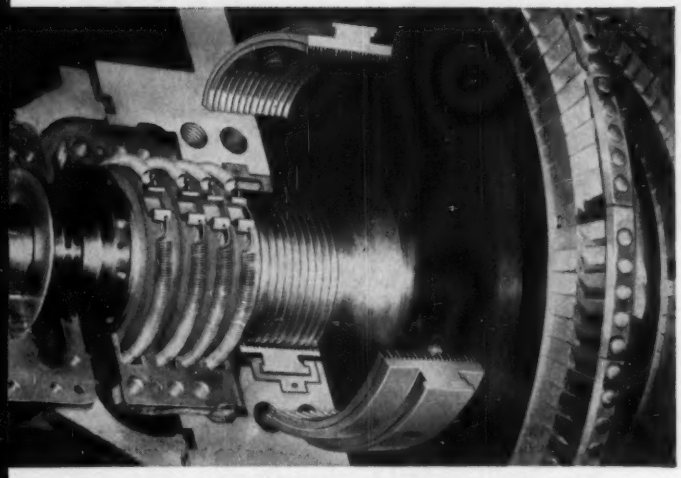
Well-designed, efficient seals...



Highly efficient, easily-replaced carbon packings

For the most effective shaft-end sealing, well-designed, low-cost carbon packings are used on G-E High-speed Turbines to seal steam pressures up to 75 psig. Made of non-galling, self-lubricating carbon-graphite, these segmental rings have high mechanical strength in the small sizes used, assuring long life under normal operating conditions. A garter spring in an offset "V" groove holds each ring together and presses it firmly against the side of the chamber, forming a tight seal. This unique arrangement permits the rings to support their own weight and to adjust themselves to the shaft position, thereby reducing wear and increasing the life of the seal. The rings are contained in compact external packing boxes, and can be easily inspected or replaced without breaking the horizontal joint of the wheel casing.

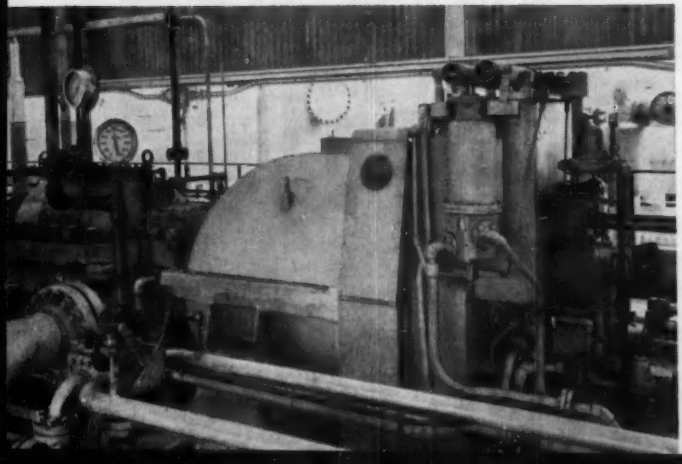
cut steam leakage...



Reliable, long-life metallic-labyrinth seals

To effectively minimize shaft-end steam leakage where shell pressures exceed 75 psig, segmental, high-low tooth metallic-labyrinth seals are used in combination with carbon packing. Between stages, straight-tooth metallic-labyrinth seals are always used. For maximum seal efficiency, minimum clearances between the teeth and the shaft are maintained by precision-machined hook fits in the packing housing. Shaft scoring is practically eliminated since the leaded-bronze segments are spring-backed and can move outward should there be accidental contact with the shaft. When unbalanced steam pressure forces axial movement of the seals, the shoulders of the rings and the housing engage to form a tight steam seal. All labyrinth seals are designed to compensate for thermal expansion, thus assuring a most efficient steam seal at operating temperatures.

reduce maintenance costs



The careful design and manufacture of these steam seals is your further assurance of low maintenance and consistent reliability of G-E High-speed Turbines. Why not check into the many other sound design features built into these mechanical drives? Your Apparatus Sales Representative will be glad to explain the many benefits they offer to your operation. Contact him for further information or write for Bulletin GEA-6232, General Electric Company, Section 241-7, Schenectady, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

ARGUMENTS . . . *it pays to pop your safeties here*

ALTHEA THORNTON, *Assistant Editor*

Critical-incident method is OK but—

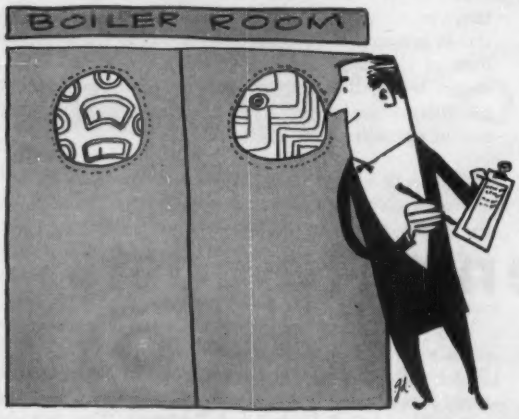
Like any other supervisory tool, much can be said both for and against the critical-incident method of employee evaluation (p 111, August POWER).

Considerable benefit can result from proper use. For instance, the method gives the supervisor concrete evidence on which to base rewards or penalties. It reveals an employee's reaction patterns so that the supervisor will know how best to communicate with him. Mutual discussion based on the notes helps to (1) change behavior, (2) reveal undesirable traits, (3) bring strengths and weaknesses out into the open (4) make the subordinate see how he can be more valuable to himself and to his company.

At the Port of N. Y. Authority we do not require a supervisor to use the method. We suggest he use it if he thinks it might be helpful. Some are trying it and do find it useful—others wouldn't touch it with a ten-foot pole. We don't force the issue because it can be helpful only if it's regarded as worthwhile.

Proper use requires a lot of work and time. The supervisor must understand its purpose and be able to write explicitly, capable of drawing valid conclusions, interested in doing a prayerful job. He must get into the habit of looking for truly "critical" events, write them down immediately and objectively, use them as aids in counseling and do all this only after he has developed within his group an understanding and acceptance of the whole thing. The climate must be right. Misuse can create suspicion, antagonism, resistance and rebellion.

R B JOHNSON *New York, N.Y.*



How many men per boiler room?

As far as I'm concerned, one operator per shift with an extra man on days is not enough for an 80,000-lb-per-hr boiler plant operating at 160 psi. Any plant planning on this is taking too long a chance.

The boiler room is important. Also it is hazardous. It should be completely covered at all times by competent operators. To me this means *never less than* two men per shift for any high-pressure plant.

With only one man in charge, protection may be totally lost in any number of situations. There could be water-supply failure, pump troubles, low or high water, priming or foaming. Stokers, fans or other auxiliaries might fail mechanically. Tubes may go out for causes other than water failure.

In the personal field, one man could be injured, become suddenly ill or require help immediately.

Even ordinary things like a large clinker formation requiring considerable time and labor for removal could effectively hamper steam production. A second man should be available even if he is only a helper or common laborer. Consider his wages as insurance rather than expense. And there is always some work he could be doing.

Many plants, some of good size, feel that one man per shift is sufficient. I have 35 years of powerplant experience, 15 in supervisory capacities, and I would not consider risking any high-pressure plant to the care of only one man at a time, no matter how well qualified.

What do other operating engineers think about this subject? What is the up-to-date trend?

L C VAN HUBEN *Orangeburg, N.Y.*

EDITOR'S NOTE: *Send in your comments on this important subject. We pay if we print your letter.*

Watch out for that easy paint mixer

It's a fire hazard. The "easy paint mixer" in July Practical Ideas caught my eye because it (1) is practical and easily made (2) does a thorough job and (3) is a very real fire hazard with open single-phase electric motor and metal impeller.

We *used to* use one like it for paint. Now it does an excellent job mixing fire clay.

WM E WALL *Pendleton, Ore.*

Watch for explosions. The paint mixer on page 125, July POWER, not only will mix paint but also will spread it, and perhaps the painter, all over the place.

When volatile vapors are drawn over the motor-brush arc, ignition can be expected. What happens after ignition depends largely on what type material is being stirred.

C H IMEL *Richmond, Va.*

Know your fire extinguishers. If you are planning to use the "easy paint mixer" mentioned above, your associates should brush up on use of fire extinguishers.

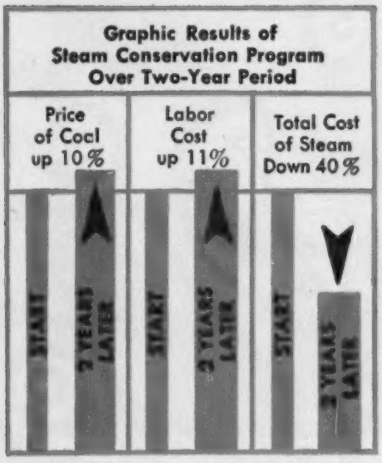
Most paints contain flammable liquids. Burning flammable liquids are called Class-B fires and the most effective extinguishers for them are foam, carbon dioxide, dry chemical and vaporizing liquid.

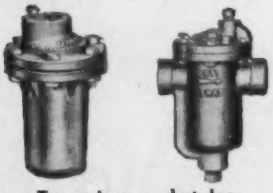
Don't use foam on electrical fires. And remember that vaporizing liquid is toxic and should not be used indoors unless a gas mask is worn.

For detailed information on how to use the extinguishers consult manufacturer's literature. Of course, it may be simpler to scrap your "easy paint mixer."

R SCHAFFER *Allentown, Pa.*

How a Major Chemical Company Cut Steam Costs $100,000 Annually





Trap sizes and styles
for every condensate drainage job.

Armstrong Traps were a "Major Factor" in Steam Conservation Says Chief Engineer

Steam waste has a way of creeping up on you. Especially in older plants. The losses can make a staggering total.

Plants looking for a way to fight rising costs can well take a page from the 8-point steam conservation program that netted a major chemical plant $100,000 annual saving:

1. **Waste steam utilized** — all flash steam recovered for building heating.
2. **New steam traps installed** — Armstrong traps replaced old traps throughout the plant, indoors and out.
3. **Steam leaks repaired.**
4. **Insulation repaired.**
5. **All condensate recovered.**
6. **Steam piping simplified.**
7. **Steam turned off when not needed.**
8. **Preventive maintenance improved** to insure a continuous checkup on sources of waste.

In commenting on the program, the Chief Engineer of the plant stated, "*4000 new Armstrong steam traps were one of the major factors in conserving steam. The traps, plus improved installation practice, have reduced annual trap maintenance parts and labor by $25,000 as compared to traps previously used.*"

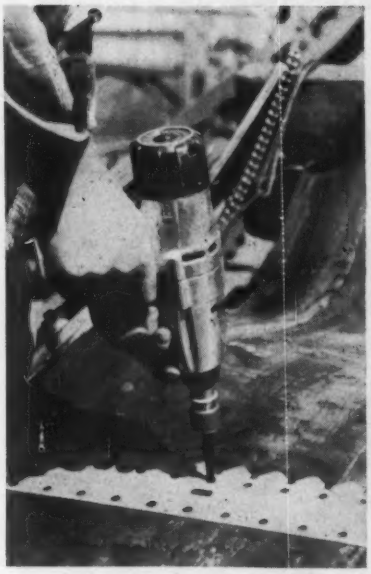
Want all the facts? Tips on cost-saving standardized trap hookups? Facts about Armstrong traps? Ask for:

1. The No. 1, 1956 issue of the Armstrong Trap Magazine containing complete details, drawings and photos.
2. The 44-page Armstrong Steam Trap Book, a fact-full guide to better trapping.

Call your local Armstrong Representative or write:

ARMSTRONG MACHINE WORKS
812 Maple St., Three Rivers, Michigan

ARMSTRONG STEAM TRAPS

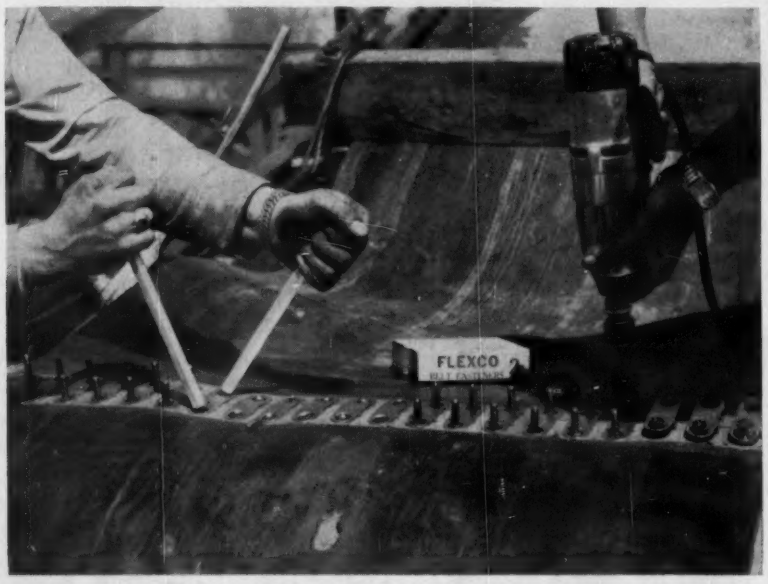


1 Use templet for positioning the holes for the fasteners. Bore holes in belt

2 After inserting the fasteners in the holes you just bored in one end of the belt, use the templet to position the bolts for the other end as shown here

HOW TO

fasten flat belts



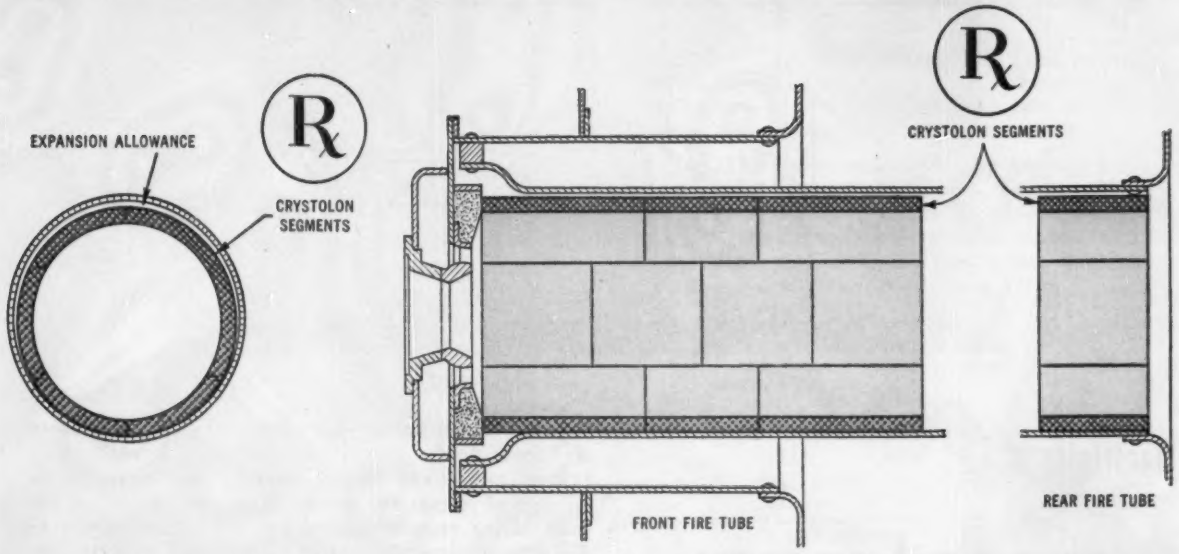
3 Next, run down the nuts with a power tool wrench to save time. Then use a bolt breaker to break off the bolt ends that stick out of the nuts. Belt is now ready

Fasten large belts in half the time usually required

► Now, you can splice large conveyor belts in much less time with the new flat fastener shown. Down time of your belt conveyors should be greatly reduced by using this method. Purpose of the templet, above, is to do away with headache of inserting the fasteners from the pulley side of the belts. New boring bit and alloy-steel wrench are designed for use in standard electric or air-impact tools. Claim is that this method will take only half the time required by the old hand method. Actual tests made in field by the manufacturer showed that a two-man team could apply fasteners on a 30-inch-wide joint in 15 to 20 minutes. Follow steps shown in the above photographs for best results.

Courtesy, Flexible Steel Lacing Co, Chicago, Ill.

How CRYSTOLON* linings pay off in packaged boiler operations



In Fire Tube Packaged Boilers the swirling action of the flame causes particularly heavy erosive and abrasive attacks on the refractory lining. CRYSTOLON refractories, with their high resistance to abrasion and erosion, make the ideal lining material. Also, their ability to take up and release heat rapidly improves combustion and flame characteristics — a further advantage for over-all boiler efficiency.

In boilers of this type use arch brick for larger boilers, tongue-and-grooved segments for smaller boilers. In water wall packaged boilers use CRYSTOLON armor block at the grate level and CRYSTOLON brick and cement to protect the bridge wall,

Norton CRYSTOLON refractories, *engineered and prescribed* for better boiler operation, are characterized by exceptional hot strength, high refractoriness and thermal conductivity and great resistance to slag penetration, spalling and abrasion. Providing maximum protection against the mechanical and chemical attacks of a wide variety of fuels, they eliminate many costly repairs to grates and settings, as well as reducing down-time.

Send for booklet

describing how Norton refractories supply money-saving Rx's for your boiler applications. Write for your copy of *Refractories for Heat and Power* to NORTON COMPANY, 449 New Bond St., Worcester 6, Mass. *Canadian Representative:* A. P. Green Fire Brick Co., Ltd., Toronto 5, Ontario.

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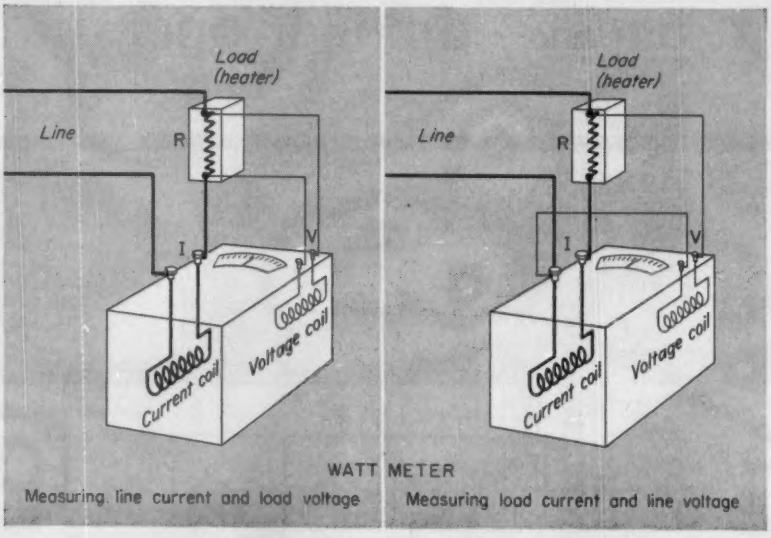
Engineered... Rx ...Prescribed

Making better products... to make your products better

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

BASICS . . . *bringing engineering theory down to earth*

NORMAN PEACH, *Assistant Editor*



Electricity: 3

Power and energy

► POWER IS THE RATE of doing work. It's work divided by time. Since work is generally expressed as foot-pounds, power could be defined as foot-pounds per second or foot-pounds per minute. Thus a 100-lb weight lifted 100 ft requires 10,000 ftlb of work no matter at what speed you move it, but it takes 10 times as much power to lift it in one minute as it does to lift it in 10 minutes.

Mechanical power is generally measured in *horsepower*. One horsepower equals 33,000 ftlb per minute or 550 ftlb per second. Basic unit of electrical power is the *watt*. One watt of power is required to force one ampere of current through a one-ohm resistor. Because a watt is a small unit, the *kilowatt* (1000 watts) is usually a more practical measure. When talking about large generating stations you'll often find power measured in *megawatts* (1,000,000 watts).

In direct-current circuits, and alternating-current circuits containing only resistance, power is easily obtained from Watt's law:

$$P = EI, P = I^2R \text{ and } P = \frac{E^2}{R}$$

P is power in watts, I is current in amperes, E equals emf or voltage in volts, and R is resistance in ohms.

Energy is capacity to do work. Energy is required to move things, to bring about chemical action, to cause heat and light and to generate an electric current. When you pay for electric "power" the basic charge is for *kilowatt-hours* of electric energy—the product of power in kilowatts and time in hours.

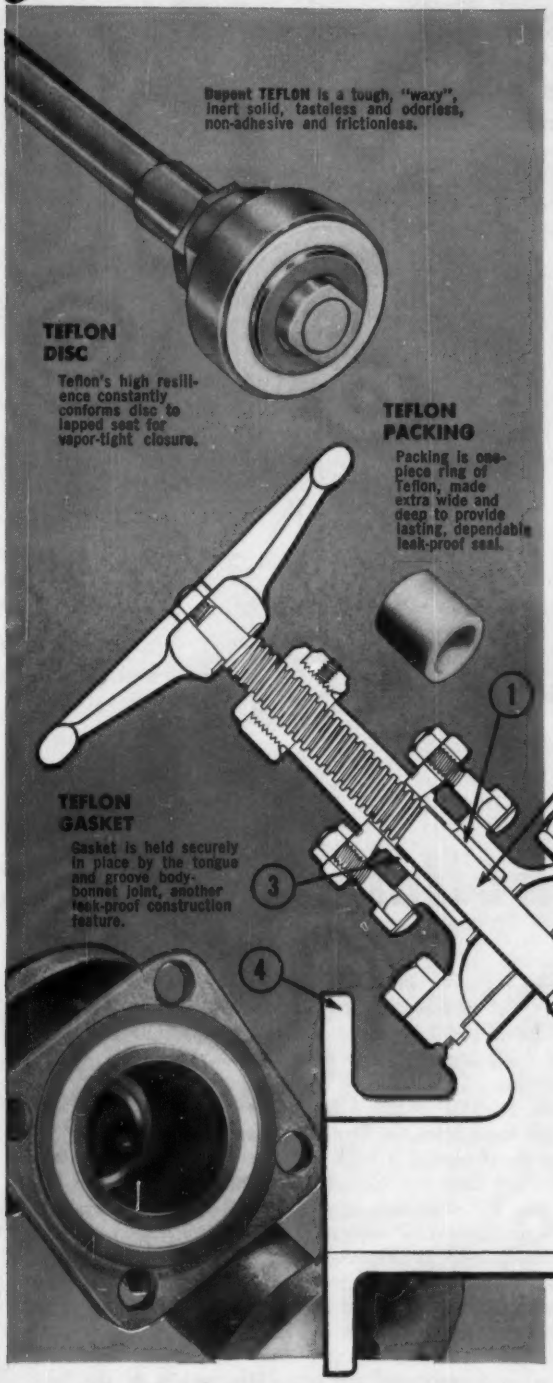
How to measure electric power. Since power is the product of current and voltage in dc circuits (and ac circuits having resistance only), you can measure power by multiplying the readings of an ammeter and voltmeter connected in the circuit. Instruments that measure power directly are called *wattmeters*. It's often convenient to use a dc wattmeter for dc power measurements. For ac circuits an ac wattmeter is usually the only practical way to measure power, since current times voltage isn't real power.

Wattmeters have two sets of terminals: *current-coil* terminals and *voltage-coil* terminals. The current coil is connected in series with the load, as shown in sketch above, and can be considered an ammeter. The voltage coil, comparable to a voltmeter, is connected in parallel with the load. Many wattmeters, in order to increase range of instrument, have more than one pair of current and voltage terminals that can be externally interconnected.

True power requires measurement of *load* current and *load* voltage. Sketch above shows that wattmeters always measure some power lost in wattmeter. In arrangement at left, the current coil measures load current, but the voltage coil measures voltage drop in the current coil as well as voltage across load. On the right, the voltage coil measures the load voltage, but the current coil carries the small voltage-coil current along with the load current. To keep losses at a minimum, where load current is large compared with voltage-coil current, use arrangement shown at right. Where load voltage is high compared with voltage drop in current coil, use connection at left. Wattmeters specify resistance of current and voltage coils so that losses can be calculated and subtracted from wattmeter readings. Calculating losses requires you to use a separate ammeter and voltmeter during the test, as is often the case with ac measurements. Some wattmeters are compensated for internal losses.

Basics for November: Conductors and Resistance.

Jenkins designed for trouble-free performance... a


Dupont TEFLON is a tough, "waxy", inert solid, tasteless and odorless, non-adhesive and frictionless.
TEFLON DISC
Teflon's high resilience constantly conforms disc to lapped seat for vapor-tight closure.
TEFLON PACKING
Packing is one-piece ring of Teflon, made extra wide and deep to provide lasting, dependable leak-proof seal.
TEFLON GASKET
Gasket is held securely in place by the tongue and groove body-bonnet joint, another leak-proof construction feature.
1
2
3
4

STAINLESS STEEL "Y"

to lower costs in a wider range of

CORROSIVE SERVICES

For food and chemcial plants, and similar services, Jenkins Fig. 1335 "Y" Globe offers many advanced features that will lower operating costs and keep your processing lines trouble-free. The disc, packing, and gasket are tough, resilient Teflon. Tasteless and odorless, it eliminates problems of contamination.

The "Y" pattern permits full flow, nearly equal to that of a gate valve, and also provides the vapor-tight closure and the ease of disc renewal of a globe valve.

Fig. 1335 offers extra value by any test . . . *initial cost, operating efficiency, low maintenance.* You can convert this extra value into *extra savings* on your toughest corrosive services. Call your Jenkins Distributor, or write: Jenkins Bros., 100 Park Ave., New York 17.

FULL, FREE FLOW
through Fig. 1335 is nearly equal to flow through a gate valve.

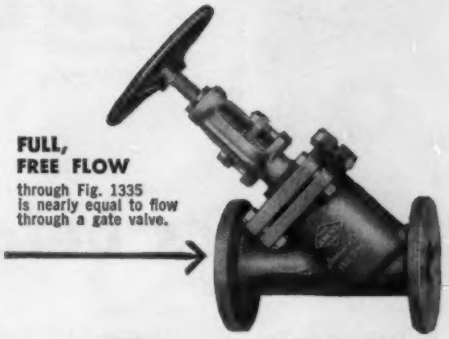


Fig. 1335 "Y" GLOBE
150 lbs. O.W.G. at 500°F
230 lbs. O.W.G. at 100°F
Sizes 1" to 4"

(1) **Packing Box**—Exceptionally deep and wide to hold optimum size packing.

(2) **Spindle**—Polished shank, long-operating threads, bevel shoulder for backseating.

(3) **Gland**—Two-piece for equalized pressure, tight seal.

(4) **Flanges**—Conform to M.S.S. Standard Practice S.P.42 Specifications.

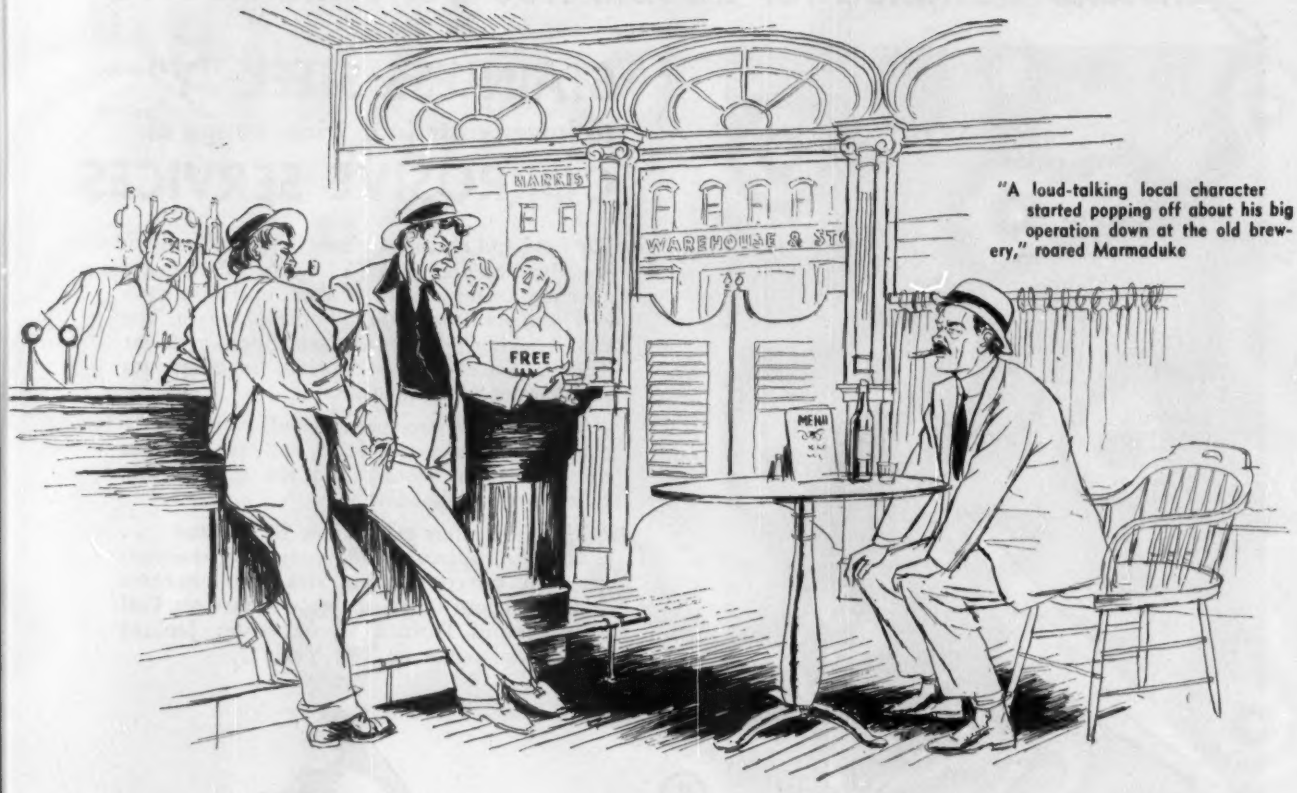
JENKINS STAINLESS STEEL VALVE BOOKLET illustrates and describes wide range of Jenkins Globe, Gate, Check, and Y Valves, includes selection data, survey forms. Ask for Form 200-A.

JENKINS VALVES

LOOK FOR THE JENKINS DIAMOND

SINCE 1864 TRADE JENKINS MARK

Jenkins Bros.



"A loud-talking local character started popping off about his big operation down at the old brewery," roared Marmaduke

Marmy's belching boiler

► TRAILING a foxy consulting engineer like Marmaduke Surfaceblow has its reward. Some of the most interesting people write to me—many have become close friends even though I've never met them.

For example, E A Roberts of Carlsbad, New Mexico writes, "I enjoy Marmy's stories so much that I've made an oil painting of him. You'll receive his portrait in oil in a few days—properly framed. If you don't want to hang him in your office, send him to the Smithsonian Institution or to the Bent. . . ."

Then Floyd McWilliams from Shawinigan Falls, Quebec writes, "Would sure as hell like to meet you, Steve—how about a fishing trip this summer? Can take you to a honky-tonk club that costs thirty bucks a day—or I can arrange a trip to one of our company's private lakes where it doesn't cost a cent. But we do our own firing, our own cooking and gut our fish. One day the little rascals jump out of the water for me—next day I get zero—that's fishing. . . . When you coming up. . . .?"

This one from Bill Pender in New Orleans, "After keeping up with Marmy, I feel I know both of you. Why not visit us? Take a river boat down the Mississippi. I'll see that you have a good time here. . . ."

Marmy's old friend Julian N Walton writes from Catlett, Virginia, "Steve, I've missed very few Marmy stories. I've got a 40-acre cattle farm and you are welcome to spend a week with me. Bring our friend Marmy with you—I'll see that he's supplied with Sandpaper Gin. . . ."

George Pearce writes from Albuquerque, New Mexico, "Don't fail to stay over for a few days if you come this way. Reina and I have a room for special guests like yourself. We'll make your visit to these wide open spaces interesting. . . ."

This morning Frank Flint writes from Toronto: "Why not get away from the Bent Propeller and from Marmy for a few days? Spend a week or two at my place on the lake up here. I have two cottages and you are welcome to one of them. We swim, fish, boat-ride and just relax in some of God's most beautiful country. . . ." And so it goes.

Since Marmy is responsible for my knowing these fine people and thousands of you other readers who start your welcome letters with "Dear Steve," I thought I'd drop in on the old consulting engineer to see what he was up to.

"BILGEWATER on taking vacations," roared the ancient sea dog when I mentioned my invitations to him at the Bent Propeller Bar. "I'll tell you about the time I cured a belching boiler down in Tennessee. And I didn't have to take a vacation to do it."

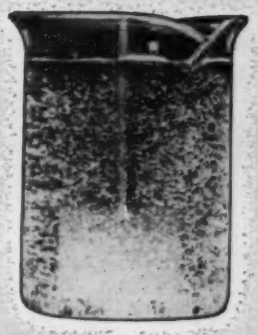
Before I could answer, Marmy backed against the bar, straightened himself to his full 6 feet 4 inches, gave his gray bowler a starboard list, then roared in his foghorn voice.

"Back in 1933 I signed off the Great Lakes ore carrier SS *Warrior* in Duluth, Minnesota, after tying her up for the season. That afternoon, the Second Assistant and I rode a side-door pullman down to St. Paul. A week later, we shipped out on a stern-wheeler (*Continued on page* 170)

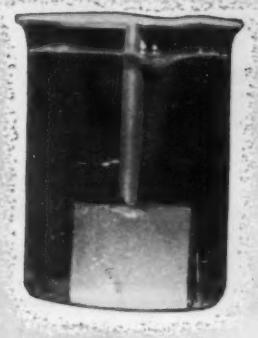
A New, Better Coagulant

NALCO 600

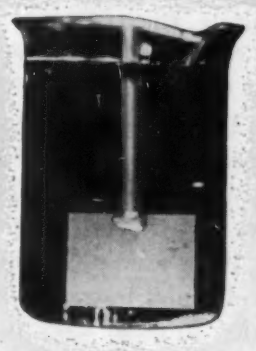
POLYELECTROLYTE



Alum



Alum plus
typical polyelectrolyte



Alum plus
Nalco 600

● As a coagulant in water clarification, and under many process coagulation conditions, new and different Nalco 600 has shown such great promise, both in performance and economy characteristics, that it has now been made available for general use as an established member of the Nalco family of chemical aids to industry.

Extremely difficult coagulation conditions provide especially economical applications for Nalco 600. It can be used alone or in conjunction with other coagulants. A very low dosage of Nalco 600 usually permits as much as 50% reduction in dosage of alum, activated silica, iron sulfate or clay type treatments . . . and results in a cleaner, clearer supernatant liquid.

Nalco 600 was invented in the Nalco Laboratories, and is being manufactured *only* by Nalco. For complete data on Nalco 600, and expert technical assistance to solve your clarification and coagulation problems, call Nalco now.

NATIONAL ALUMINATE CORPORATION
Telephone: POrtsmouth 7-7240
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IN CANADA: Alchem Limited, Burlington, Ontario
NORTHWESTERN UNITED STATES, HAWAII and ALASKA
The Flox Company, Inc., Minneapolis 3, Minnesota
ITALY: Nalco Italiana, S.p.A. SPAIN: Nalco Espanola, S.A.
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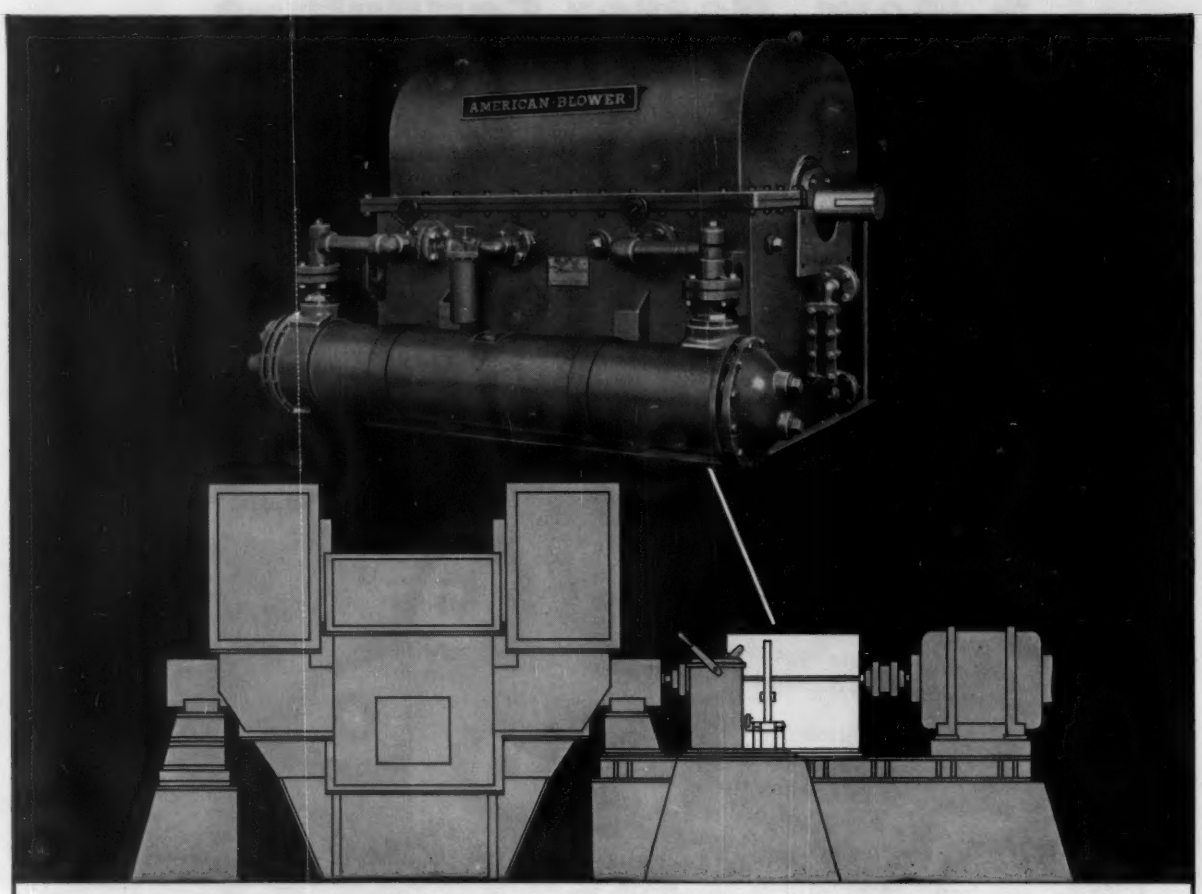
ANOTHER *Nalco*® **PRODUCT.** **Serving Industry through Practical Applied Science**

The tougher the duty, the more

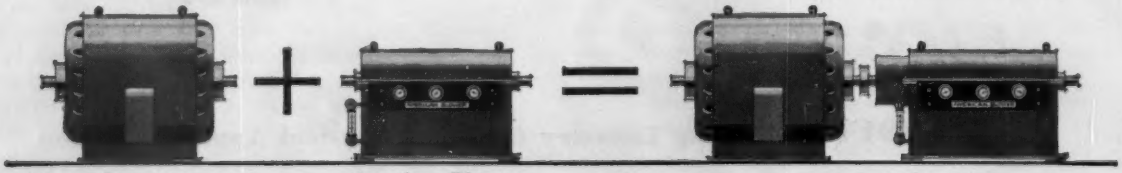


Mechanical Draft Fan Gyrol Fluid Drive Motor

LARGER MECHANICAL DRAFT FANS — Gyrol Fluid Drive gives you the kind of accurate, efficient control of mechanical draft that results in important power savings, longer equipment life. The reason: Fluid Drive's infinitely adjustable speed control, which enables each fan to operate at its optimum design or selection point.

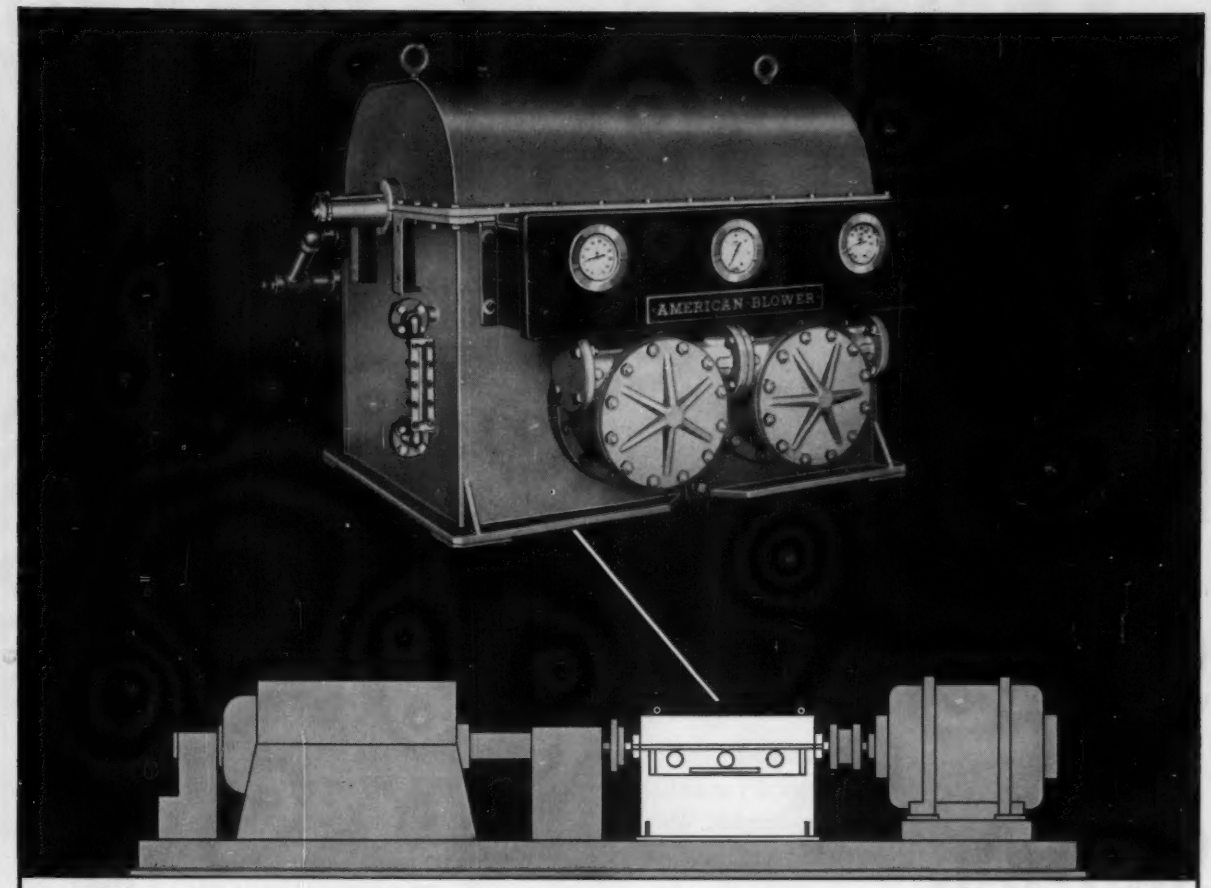
This adjustable-speed feature saves horsepower, gives good, stable volume and pressure control over the operating range . . . simplifies motor-starting equipment . . . reduces damaging high- and long-duration inrush currents on the motors . . . provides no-load starting of high WR^2s that exist in the new, high-volume, high-pressure fan wheels.

What's more, it prolongs life of fan bearings; reduces fly-ash abrasion on fan wheel, fan scroll, inlet boxes, and breeching connections. When you add to these advantages the reduction in noise level, it becomes increasingly clear that the tougher the duty, the more you need Gyrol Fluid Drive for control of mechanical draft.



Rugged constant-speed induction motor American Blower Gyrol Fluid Drive Smooth, adjustable-speed control

you need Gýrol® Fluid Drive



Boiler Feed Pump | Gýrol Fluid Drive | Motor

LARGER BOILER FEED PUMPS — As larger boiler feed pumps are built, there is a greater need for higher efficiencies and more accurate control. That's why more and more consulting and utility engineers are recommending Gýrol Fluid Drive.

You see, Gýrol Fluid Drive offers adjustable-speed pump control that saves power over the entire operating range by eliminating wasteful throttling. Then, too, Fluid Drive reduces wear on bearings and other vital parts by operating the pump at speeds that fit boiler demands. Paralleling of pumps is simplified. And emergency changeover from operating to standby pump is fast and foolproof—there's no need for boiler shutdown.

If your plant expansion calls for boiler feed pump control, it will pay you to talk to an American Blower engineer. He can show you where Gýrol Fluid Drive can save power, cut costs, give you a more efficient operation. Contact our nearest branch office, or write us direct. American Blower Corporation, Detroit 32, Michigan. In Canada: Canadian Sirocco Company, Ltd., Windsor, Ontario.

AMERICAN BLOWER

Division of American-Standard

Reader service section

Start with these quick samples . . .

Pipe dream . . .

comes true in Ohio where a pipeline, 108 miles long, is being readied to carry coal from mine to plant. Coal will be pulverized, mixed with water and pumped to generating plant where it will be dried and fed into boilers. If you want to be the first in your field with the facts, keep a weather eye on our . . .

Reports From the Field, p 150

Brevity is the soul . . .

of our reports to you on the newest and best in technical papers. This month's 31-paper roundup covers four facets of the power field: gas turbines, electric motors, rectifiers and corrosion. If you want the full reports, we've supplied info on where to get them.

Technical Briefs, p 152

Two for the money . . .

Dual-shaft series-flow gas turbine is doubly valuable since it can be used for stationary or portable power generation. This is only one of many recent power developments. When your boss asks you what's new, you can tell him if you have read . . .

Plant Equipment News, p 158

Three to make ready . . .

Three easy steps and you're ready to receive any of the manufacturers' bul letins in our monthly listing. Choose your items, list them on the post cards we provide, and mail. It's as easy as that.

Free Literature, p 165

Pride and prejudice . . .

may lead you into making a hasty judgment. If you think you can judge a book by its cover or a man by his appearance, you'll find some food for thought in a story cited by the old engineer-philosopher. In any case you'll find some plain good reading in . . .

George Edwards, p 168

For other timely ideas, see following service pages ▶

How it Works!

Only new Sarco TD steam trap uses kinetic energy of steam to close valve

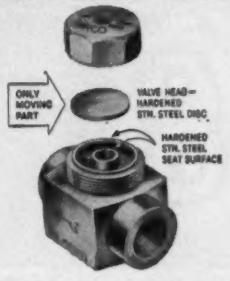
GAS MANTLES have been replaced by electric lights, steam locomotives by diesels, propeller planes by jets.

Now, the use of the kinetic energy of steam principle gives us a modern type steam trap.

The Sarco TD obsoletes all other types for 10 to 600 psi installations. For example, it operates without a valve closing device—no bucket, float, bellows, pins, levers or gaskets.

Glance below and you'll agree that no other steam trap is even similar to the Sarco TD!

For a trial installation—write today.



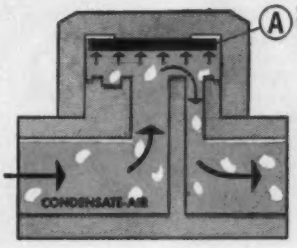
Only 3 parts...all stainless steel

Sizes ⅜ to 1"—each body is as small as a tee fitting! Capacity is determined not by a bulky body but by the effective orifice, valve action, pressure drop and condensate temperature.

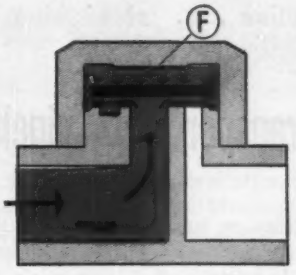
Many Advantages

1. *Practically no maintenance*—no valve mechanism, no narrow channels. Trouble-free simple design. Only 3 parts—all stainless steel.
2. *One trap for all pressures*—self-adjusting. One large capacity seat for 600 psi as for 10 psi. No changes or adjustments.
3. *Operates equally well on all loads*—on heavy, light or no condensate load. No prime to lose. No adjustments.
4. *No steam leak required*—to operate the Sarco TD. Closes tight against steam.
5. *Discharges at steam temperature and vents air* and air-steam mixtures at start-up and during operation.
6. *Freeze-proof*—when installed with outlet down, free to drain.

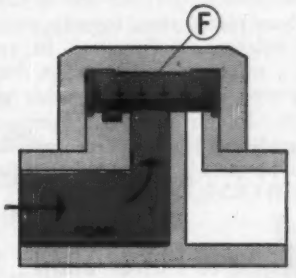
Only Sarco TD Thermodynamic Steam Trap Uses This Unique Operating Principle Which Permits Trouble-Free TD Design



1. Inlet pressure raises disc "A" from seat... immediate discharge of air and condensate at steam temperature.



2. Steam follows the condensate and the high velocity jet across the bottom of disc "A" creates a low pressure area (Bernoulli effect)...the jet is deflected into chamber "F" where it builds up pressure by recompression and this pressure acts on the top of the disc "A"...



3. Pressure in chamber "F", acting on full top area of disc "A", exceeds force of incoming steam and low pressure area under the disc...and immediately forces it down, closing the inlet. As condensation decreases the pressure in chamber "F", the disc rises and steps 1 or 2 repeat.

60-day trial convinces...No obligation...Use coupon!

SARCO

Steam Traps—Temperature Regulators—Strainers—Heating Specialties

SARCO COMPANY, INC., Empire State Bldg., New York 1, N. Y.

Please send me Sarco TD Steam Trap and strainer for 60-day trial. Size_____

For installation on_____

Name_____ Title_____

Firm_____

Address_____

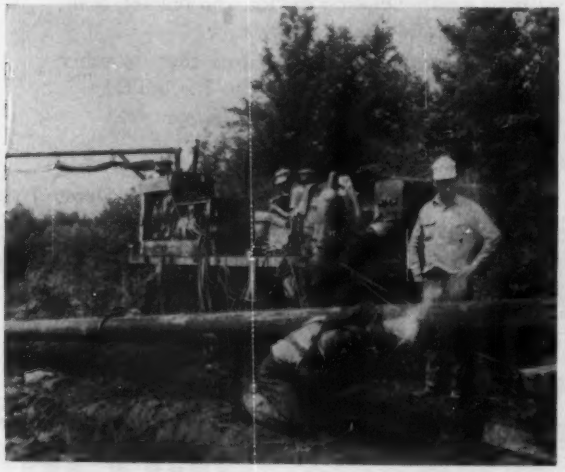
City_____ State_____

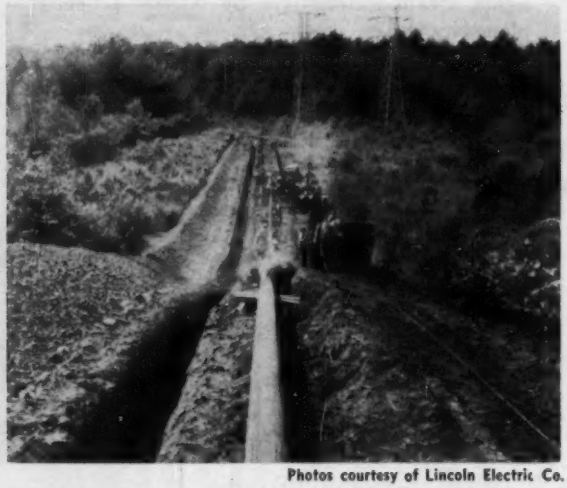
2184-C

REPORTS FROM THE FIELD

What's happening in power and what it means to you

For Calendar of Events see page 234





Photos courtesy of Lincoln Electric Co.

Welding crews lay 10-in. pipeline . . . stretching 108 miles over Ohio hills

Coal to be transported by pipeline in Ohio

► COAL, pulverized and suspended in water, will be flowing through a pipeline over Ohio hills in a few months.

This door-to-door delivery system stretches for 108 miles. The 10-in. pipeline runs from Hanna Coal Co strip mines, south of Cadiz, Ohio, to the Cleveland Electric Illuminating Co's Eastlake Generating Plant, located just east of Cleveland, Ohio.

Coal and water mixture will travel 3½ miles an hour. On arrival at the generating plant, it will be dried and fed into boilers.

Two pumping stations and a spare have been placed along the way, roughly 30 miles apart. Spare will be used when a regular pumping station drops below 80% of the top operating efficiency. Pumps are high-pressure, adjustable-speed, piston-type machines driven by electric motors through fluid clutches. They will create a 1000 psi pipeline pressure.

It is anticipated that the line will be capable of delivering 1,300,000 tons of coal each year. The Pittsburgh Consolidated Coal Co, after five years of research, decided that this was a feasible way to transport coal and is now in the process of turning the idea into a reality.

Because of the erosive-corrosive nature of the fuel, heavy wall sections and high-tensile steel were used in the line. Pipe used was 5LX-42 spec.

Crews laid and welded better than 2.5 miles of pipe daily. Two weldors applied the stringer bead. This probably was the most critical pass in the welding operation because 100% penetration had to be achieved and the weld had to be absolutely free of slag.

The coal company plans now to pump water through the line for a month or so to test pumps, clean the line and check it for pressure.

Cleveland Electric Illuminating Co may buy the pipeline in 15 years if it chooses. Meanwhile CEI will be helping with the pipeline's cost.

Rockets and missiles latest addition to Power Show

► ASME, sponsors of the National Power Show, are promising engineers a Roman Holiday, complete with Coliseum, when the show bows in New York on Nov. 26.

There won't be any lions. Their roar has been replaced by the well-mannered purring of powerful machinery; a sound infinitely more exciting to engineering ears.

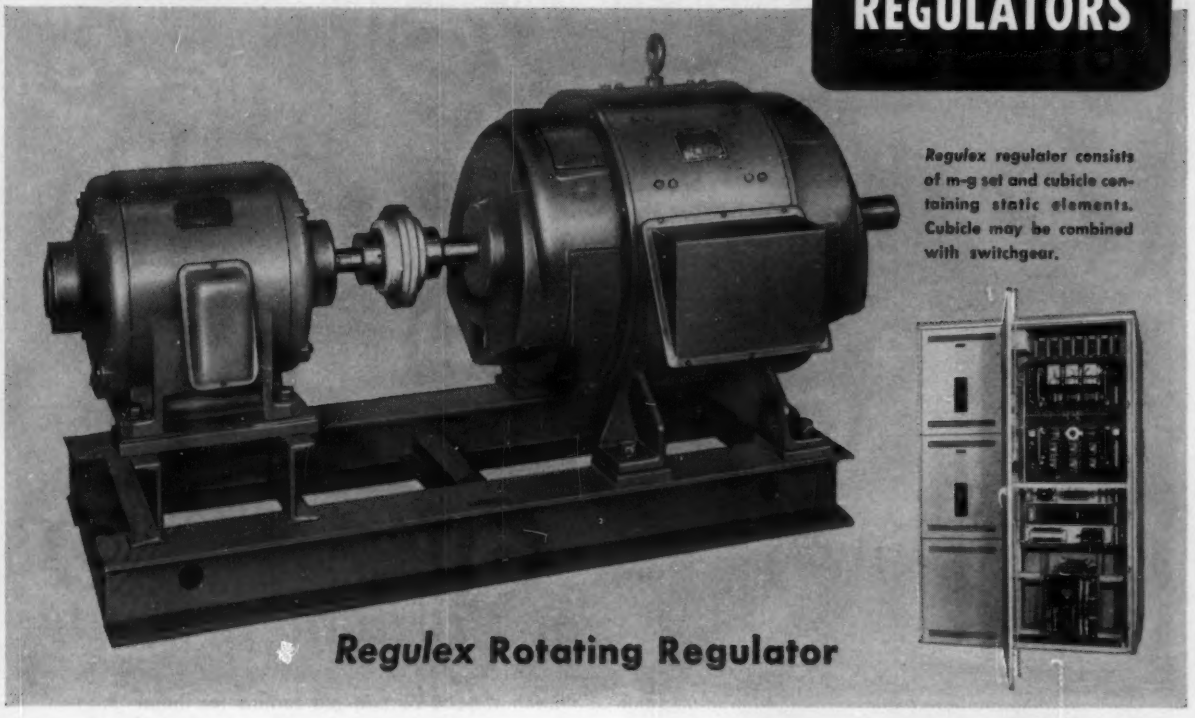
Latest addition to the growing list of exhibits is the Rockets and Missiles Section, actually a show within a show, sponsored by the American Rocket Society. This announcement came just as POWER went to press.

Even before the announcement of the new section, several displays having a direct bearing on similar activities were enrolled in the exposition. Spokesmen for the show say that one such exhibit will reveal a scale model of a liquid-propellent rocket engine, a scale model of a rocket engine test-stand and pictures of the design, development and

(*Continued on page* 232)

A Type and Size for Your Specific Needs

ALLIS-CHALMERS REGULATORS



Regulex regulator consists of m-g set and cubicle containing static elements. Cubicle may be combined with switchgear.

Regulex Rotating Regulator

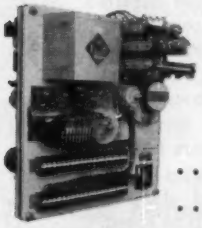
- Stability during high power-factor operations.
- Increased operating limits through automatic minimum excitation.
- High sensitivity and rapid response.

How It Works . . .

Automatic minimum excitation permits generator operation close to stability limit — much closer than manual operation. Sensitivity and quick response of *Regulex* regulator establish and maintain safe ratio between generator load and field current.

Where It Is Used . . .

In power plant application for voltage regulation of large generators or synchronous condensers. In industrial applications for regulating current, voltage, speed, tension, and reversing of processing mill equipment, and for arc-furnace control.



Magnetic AMPLIFIERS

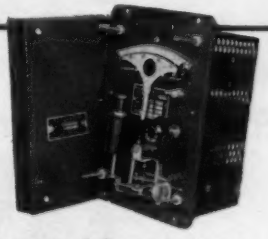
. . . Low maintenance

. . . High sensitivity

Designed for applications requiring high sensitivity and response, where regulator is subjected to shock, or where continuous performance is a prime factor. Used in conjunction with *Regulex* unit when reversed polarity output is required. Since the magnetic amplifier has no moving parts it requires little maintenance.

For complete information call your Allis-Chalmers representative, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

Electromechanical *Rocking Contact* Type Regulators



For voltage regulation of smaller ac and dc generators.

- Varies resistance in exciter shunt field by rocking action.
- Quick regulation over entire range with short movement.
- No sluggish relays.
- No vibrating or sliding contacts to wear.

Regulex and *Rocking Contact* are Allis-Chalmers trademarks.

ALLIS-CHALMERS

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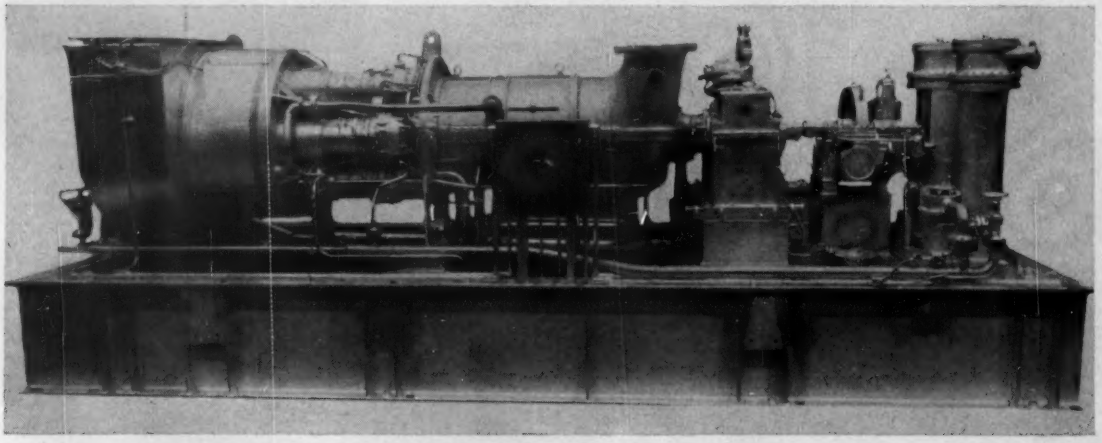
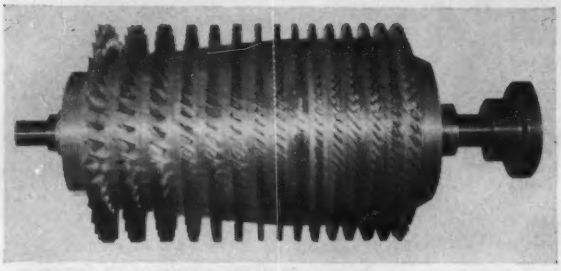
TECHNICAL BRIEFS

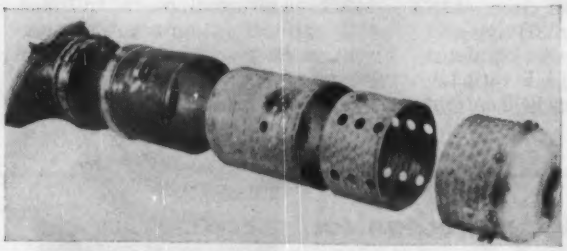
Latest engineering developments for busy power men

31 Papers for you on
GAS TURBINES
ELECTRIC MOTORS
RECTIFIERS
CORROSION

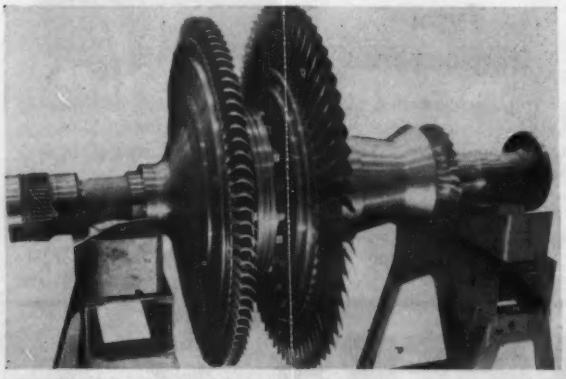




COMPRESSOR ROTOR for 4870-hp gas-turbine power plant



COMBUSTION-CHAMBER liners, cap, transition piece for unit



TURBINE-ROTOR assembly with its high-, low-pressure packing

First U.S. industrial gas turbine is ready

A 5000-kw fuel gas turbine for industrial power. *By R J Brown and A N Smith, General Electric Co.*

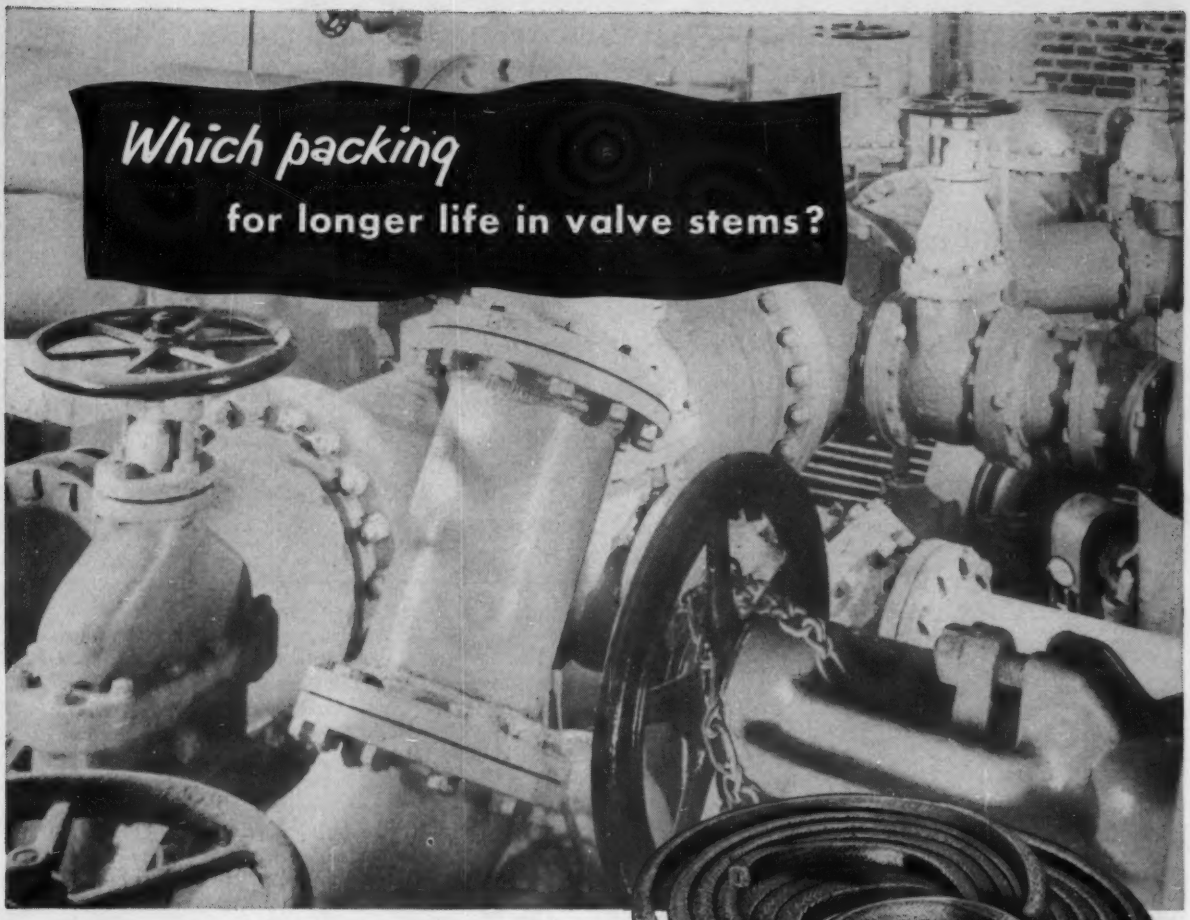
This paper describes the design details of a 5000-kw dual-fuel simple-cycle single-shaft gas-turbine generator. This unit is the first to be installed in a manufacturing plant in the U.S. Expected performance is also discussed.

Photos herewith show many details of the unit. Its axial-flow compressor has 15 stages, while the turbine has two stages. The six combustion chambers operate at discharge temperatures up to 1450 F. Lube system is similar to that for steam turbine. A steam turbine is used to start the plant.

Controls for starting and stopping the plant, controlling the turbine speed, temperature and fuel are also discussed. The gas turbine and accessories are mounted on a steel base. Reduction gear, generator and exciter are on a matching base. Outline dimensions and weights are given for installation information. *ASME paper.*

An industrial plant installation of a gas turbine to generate power and process steam. *By H L Dwyer, Stearns-Roger Mfg Co, and C A Payne, Gates Rubber Co.*

Design features and economics are presented for the first industrial manu-



. . . for heavy fluids, steam, water and gas . . . *it's J-M Jewett®*

Strong, tough Jewett has been proven the ideal packing for heavy duty valve stem service against crude and heavy oils, tar, molasses and other heavy gummy fluids. It also provides efficient sealing against steam; fresh or salt, hot or cold water; air; gas and some chemicals requiring a packing free from rubber.

The basis of Jewett's exceptional durability is its construction of high-quality long fibre asbestos yarn with fine copper wire inserts. This yarn is braided over a lead ribbon core and formed square. Style 10 is treated with a heavy bodied, heat-resisting lubricant which won't bleed in valve stem service. Furnished graphited in coil or ring form in sizes from ⅛″ up.

. . . for superheated steam and gases to 900F *it's J-M High Temperature*

When valves are operating in high temperature service, your best packing choice is Johns-Manville High Temperature Style 398. It retains its resilience, holds a tight, lasting seal against superheated steam and dry gases under elevated pressures and temperatures up to 900F.

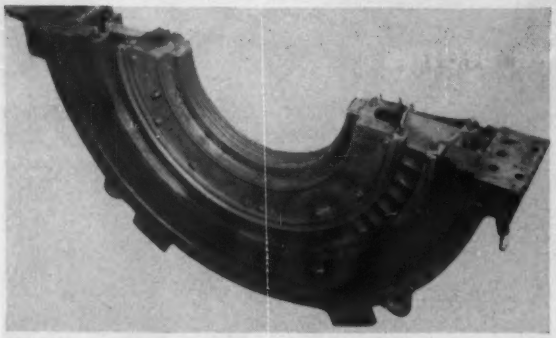
To obtain this high sealing efficiency, Johns-Manville braids asbestos yarn of high purity over a plastic core of special heat resistant composition. For extra strength, the yarn is reinforced with tough heat and corrosion resistant Monel wire. The packing is formed square and then lubricated with mica. Furnished in ring, coil and spiral form in sizes ¼″ to 1″.

Your local J-M distributor carries full stocks of Jewett, High Temperature and other packings. Call him today or write Johns-Manville, Box 14, New York 16, New York. In Canada, Port Credit, Ontario.

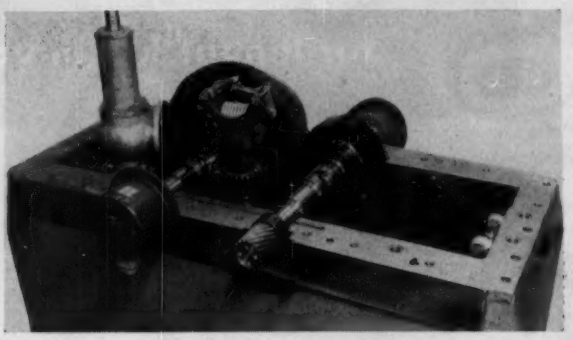
Johns-Manville PACKINGS, GASKETS and TEXTILES

More TECHNICAL BRIEFS

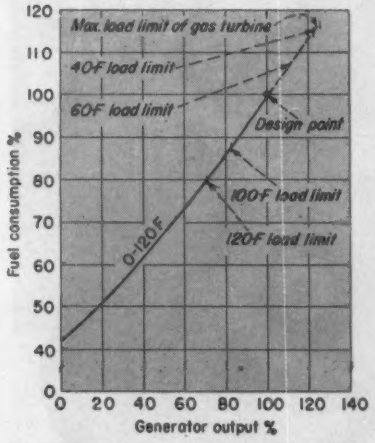
Begins on page 152



SECOND-STAGE NOZZLE and packing for 5000-kw gas turbine



ACCESSORY GEAR with top removed to show gears, governor



ESTIMATED performance of 5000-kw simple-cycle single-shaft gas-turbine plant

facturing plant installation, in the U.S., of a gas-turbine generator with a heat-recovery boiler to produce steam for process, or to supply existing steam-turbine generators.

Capacity of the boiler unit will be increased by supplementary firing, with either natural gas or heavy fuel oil, with all the combustion air supplied by the turbine exhaust. A forced-draft fan will make it possible to secure full boiler capacity during outage of the gas turbine.

This and the previous paper give a good coverage of this new unit, together with the operating results expected. The actual performance of this installation will be interesting to follow. *ASME paper.*

The present state of power production and utilization in Australia and its development since 1950. *By the Australian National Committee.*

This report deals with the energy resources of Australia and the territories of Papua and New Guinea, with emphasis on the changes which have occurred in the estimates made since 1950, and in the state of power production and utilization and its development since that date.

By far the most important source of energy is coal, and for the sake of easy comparison, the reserves have been expressed in terms of kilogram calories as well as by weight. While the coal position in recent years has remained static, the use of water power is undergoing active expansion. *WPC paper No. 41A8.*

Energy resources and development of power production in Pakistan. *By S A Hasan, Electric Power Central Engineering Authority.*

This paper briefly reviews the energy resources of Pakistan and discusses the history of power development in the country since partition in 1947. The energy resources in general are limited. Hydro potentials are hundreds of miles away from the centers of consumption and their development is expensive. Water resources at Warsak, Mangla and Karnafuli have, however, been planned for power development.

There are no natural fuels that can be suitably utilized for large-scale power generation. The production of coal is about 25% of the minimum requirements of the country, resulting in its indispensable and expensive import from foreign countries. The yield of fuel oil also is only about 15% of the present requirements. Natural gas has recently been found but is limited in quantity and its use is restricted within a limited radius. This gas is proposed to be utilized mainly for the manufacture of chemicals and fertilizers and partly in a power station of 127,000-kw installed capacity.

There is no indication of the existence of the necessary raw material for atomic power. It is, however, felt that atomic power could make up the general deficiency of the natural fuels in the country for power production.

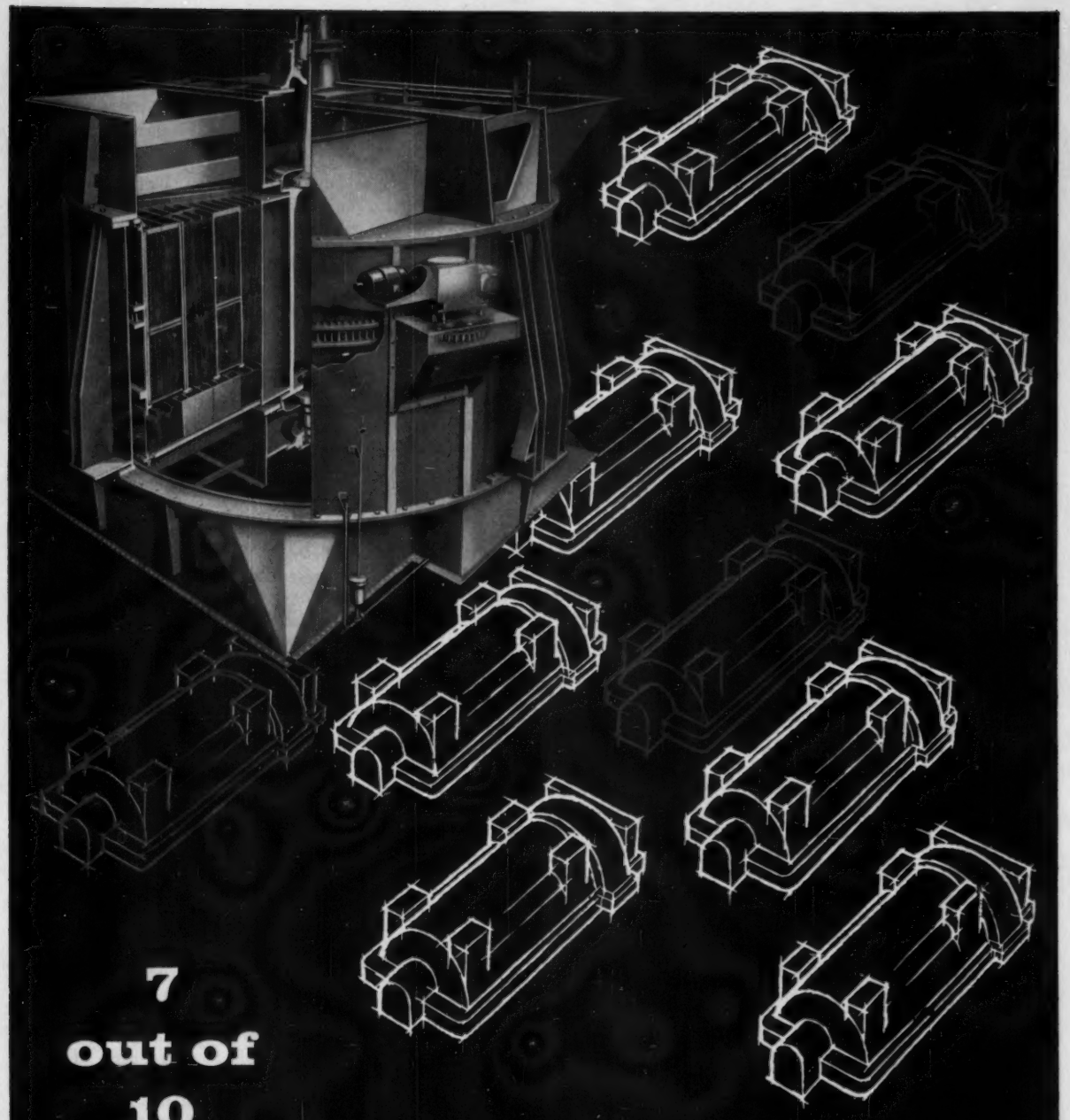
Seven power stations with a total capacity of 140,000 kw are being installed at different demand centers, and are expected to go into operation by 1955-1956. More schemes for development in the light of the changed pattern of industrial structure are under the active consideration of the government. *WPC paper No. 49A10.*

Sweden's energy resources and power development since 1950. *By Folke Petri, and Erik Blomquist.*

Figures are given relating to the energy resources and power development in Sweden since 1948. Coal, coke and oil are mainly imported. The production of wood fuel and peat has decreased. There are no resources of natural gas. The water-power resources are most important, most electricity being generated by water-power plants; on an average, only 6% is produced by steam power plants.

About one third of the usable water power has so far been developed; a considerable construction program now in progress will bring the water-power production up to 37,500 x 10^6 kwhr per year in 1960. Because most of the big water-power resources are located in the northern part of Sweden, whereas the use of electric power is to a great extent concentrated in the south, long high-tension transmission lines have

Directions for ordering papers on p 222



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The Air Preheater Corporation 60 East 42nd Street, New York 17, N. Y.

More TECHNICAL BRIEFS

Begins on page 152

been built as a necessary complement to the arrangements for the generation of power. *WPC paper No. 56A12.*

Energy resources of the United Kingdom and trends in their utilization. *By The Chief Scientist's Division, Ministry of Fuel and Power.*

A review of the energy resources of the United Kingdom shows little change since 1950. Imported energy, particularly of petroleum, is however, assuming a steadily increasing importance in the fuel and power pattern. Until nuclear energy assumes a significant role, only strict attention to fuel economy will avoid a difficult period during the next two decades.

Developments for the exploitation of coal resources by new methods of mining, loading and transport (including hydraulic transport) and by underground gasification are discussed. Coal methane drainage is now accepted practice and the gas is utilized commercially. Current developments in the utilization of oil shale, peat, water power, sewage methane and wind power, are described.

The use of fuel and energy in coal mining, the gas and electrical industries, transport and general industry, are examined as are future trends and their interrelation with the "Clean Air Policy" of the United Kingdom. *WPC paper No. 59A13.*

Energy resources of the United States. *By Ralph L Brown, U.S. Department of the Interior.*

The primary sources of energy and of electric power production are coal, oil, natural gas, and waterpower. Important potential sources are oil shale and nuclear fission and eventually energy from the utilization of solar energy.

Realistic reappraisal of known coal reserves indicates 1.7×10^{12} metric tons yet in the ground in the United States. Coal supplies about 30% of the total energy demand and 50% of the energy for generating electric power.

Petroleum reserves continue to gain; these amounted to about 4.7×10^{9} kl at the close of 1954, an increase of about 38% over those of 1947. The ratio of proved reserves to annual production holds steady at about 13. Similarly, reserves of natural-gas liquids in 1954 were 834×10^{6} kl, an increase of 60% over those for 1947; the ratio of reserves to production remains at about 17.5. Successful development of production of oil and gas from the Continental Shelf is well underway.

Natural-gas reserves in 1954 stand at about 6×10^{12} m^3, an increase of about 28% since 1947. In this period consumption increased 67%. The ratio of reserves to annual consumption now stands at about 22.5.

Potential shale-oil reserves, recoverable under present economic conditions and status of technological development, are large, variously estimated at 60 to 90 $\times$ 10^{9} kl. Basic mining, oil recovery, and refining technology, are now well advanced and active industrial interest in exploitation is mounting. *WPC paper No. 63A14.*

Hydroelectric power development in the United States. *By Frank L Weaver, Chief, Division of River Basins, Bureau of Power, and George G Adkins, U.S. Federal Power Commission.*

The generating capacity installed in existing hydroelectric power plants in the United States as of January 1, 1955 aggregated 24,238,318 kilowatts, or 20.4 percent of the nation's total generating capacity—an increase of 7,603,278 kilowatts since January 1, 1949. The hydroelectric generation in 1954 was approximately 112 billion kilowatt-hours or 20.5 percent of all generation in the country. Although the total number of hydroelectric plants at the end of 1954 was about 1,756, more than 54% of the existing capacity was installed in 60 plants, each designed for ultimate capacity of 100,000 kilowatts or more.

Estimates by the Federal Power Commission, based on information from various sources, place the total undeveloped hydroelectric power in the United States as of January 1, 1955 at approximately 82.8 million kilowatts of capacity, with corresponding average annual generation of some 362 billion kilowatt-hours. These estimates include the capacity under construction. Thus, the total potential hydroelectric capacity, developed and undeveloped is estimated at 107 million kilowatts of which some 22.6 percent has been developed. The largest amount of hydroelectric power, both developed and undeveloped is found in the Pacific Division, principally in the Columbia Basin. *WPC paper No. 64A15.*

Energy resources and power developments in Norway. *By the Norwegian National Committee.*

Because of its orographic and climatic conditions Norway is one of the countries in Europe which possesses the biggest supply of water power. The country's average altitude is about 500 m above sea level, and the net precipitation about 1200 mm per annum. A large part of the precipitation falls in the form of snow. The runoff is unevenly distributed during the year, but the numerous lakes, many of them situated at great heights, provide excellent opportunities for regulation without causing much damage to cultivated areas. It is estimated that reservoirs can be constructed for a capacity of about 50 to 60 $\times$ 10^{9} cu m so that about 70% of the runoff can be utilized for regular energy production.

Through such regulation the potential all-year-round capacity (regulated low-water capacity in a year of general water-shortage) would be 12.5×10^{6} kw at 82% efficiency, corresponding to an energy production of about 110 $\times$ 10^{9} kw hr per annum, preliminary figures. In addition to this, there is about 10 $\times$ 10^{9} kw hr flood-water power which can be used. During the past year the hydroelectric energy production was about 22 $\times$ 10^{9} kw hr. Most of the installed turbines have been made in this country. *WPC paper No. 110A17.*

Energy resources and power development in Israel. *By the Israel National Committee.*

The paper reviews the energy resources of Israel with special reference to the possibilities of the development of water power and the use of oil shale, available in many parts of the country. Present energy generation is based on liquid fuel, the annual consumption of which is stated. Research work being done in Israel for the use of wind, solar and atomic energy is mentioned.

The second part of the paper describes the development of generation and use of electricity and gives figures on the use of prime movers for irrigation (pump drive), on rail traction, road vehicles and industrial l-p steam generators. *WPC paper No. 125A18.*

Energy resources and power developments in Iceland. *By the Icelandic National Committee.*

Energy resources in Iceland are, for all practical purposes, limited to water power, natural heat and peat deposits. Systematic and comprehensive surveys of these resources have not yet been

(*Continued on page* 212)

Two Separate Circuits Mean Reliable Rectifier Operation

ALLIS-CHALMERS
Mercury Arc Rectifiers

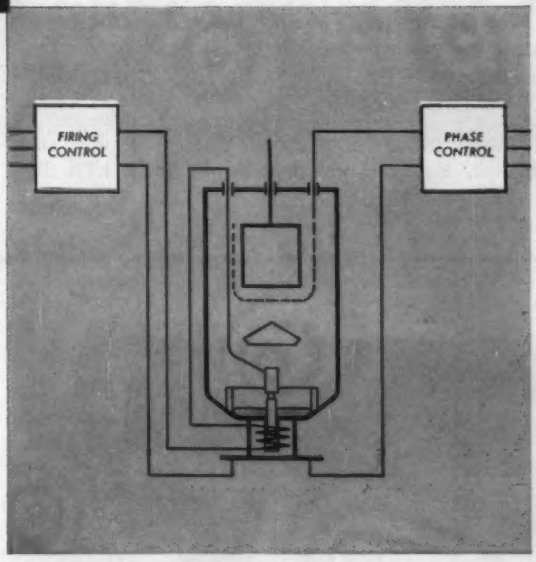
One of four metal-enclosed assemblies in a midwestern installation with a total capacity of 15,000 kw at 620 volts, dc.

1. Firing Circuit

A small dc excitation arc is automatically ignited only once, when the unit is started. It is then maintained on the mercury cathode of each rectifier tube. It offers advantages similar to a pilot light. Since it is far easier to maintain an arc than to start it, this feature reduces the chance of the excitron losing excitation during power supply disturbances.

2. Phase Control Circuit

A separate circuit utilizes the deionizing grid to obtain phase control. Grid-type phase control permits operation in the clean region near the anode where ion density is lowest, instead of on the surface of the cathode mercury pool where there is turbulence and contamination. Reliability of phase control does not depend on the condition of the mercury. This is an exclusive excitron feature.



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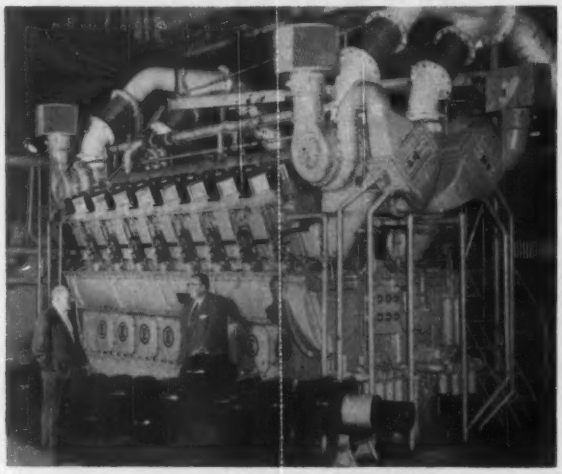


Offer line of V-type industrial diesels

1001 • *RV-16*, a prototype of a new line of industrial V-type diesel engines, has a verified rating of 7700 hp at 400 rpm, according to manufacturer.

Unit has a master-slave arrangement of connecting rods that puts opposing cylinders in same plane. Bare engine weighs nearly 182,000 lb, is 20½-ft long, 9½-ft wide and 11½-ft high. Equipped with four Brown Boveri *VTR 320* turbochargers, engine on test, photo right, weighs 189,000 lb, is 26-ft 4-in. long, 12-ft 1-in. high.

The *RV* engines will be built in 12- and 16-cyl models. They will provide power for (1) electric generation in municipal or industrial-plant applications (2) oil or water pumping stations (3) main propulsion in towboats and seagoing freighters.

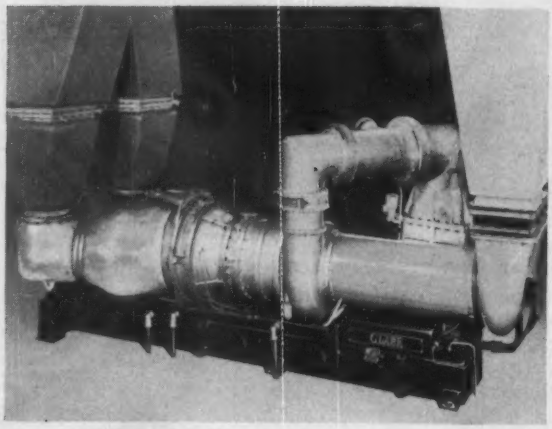
For each pair of pistons there is only one rod connected in conventional manner to the crankshaft. Other rod is a short "slave" linked to the "master" rod. This arrangement means there are only a maximum of eight connecting-rod bearings and therefore, according to manufacturer, greater crankshaft bearing area for thrust from each piston. Areas are additionally increased by a re-entrant fillet design in the crankshaft. Together with other design aspects, the bearing construction gives the *RV-16* a calculated load carrying capacity 2.8 times that of the company's *R-Series* diesels.

Normally aspirated or turbocharged, the *RV* engine can be furnished to operate on diesel or heavy fuel, or as a dual-fuel engine, spark-ignited gas engine or tri-fuel plant —the latter being a nearly universal arrangement capable of burning diesel oil alone, or gas ignited either by pilot oil or by spark.

Engine frame of the *RV* unit is built in four cast-iron pieces: base, crankshaft and two identical cylinder blocks. Further information available on request to manufacturer.

Enterprise Engine & Machinery Co,
18th and Florida Sts, San Francisco 10, Calif.

For more data on these items, use post cards page 165. Identify your request with item number.



Gas turbine can be stationary or portable

1002 • *Mark TA* gas turbine, a product of Ruston-Hornsby, Ltd, Lincoln, England, is now being manufactured and sold in this country. The dual-shaft series-flow unit operates on a simple open cycle, develops 1130 bhp at 80 F and 1000 ft. Nominal low-pressure or output-turbine speed is 6000 rpm. Output speeds of 1500 to 1800 rpm are available for driving 50- or 60-cycle generators. These speeds are obtained through use of built-in planetary gears.

Unit is well suited to stationary or portable power generation and to marine and industrial mechanical drives. Typical areas of use are gas and fluid transmission where variable-speed or high-starting torque characteristics of a two-shaft turbine are required.

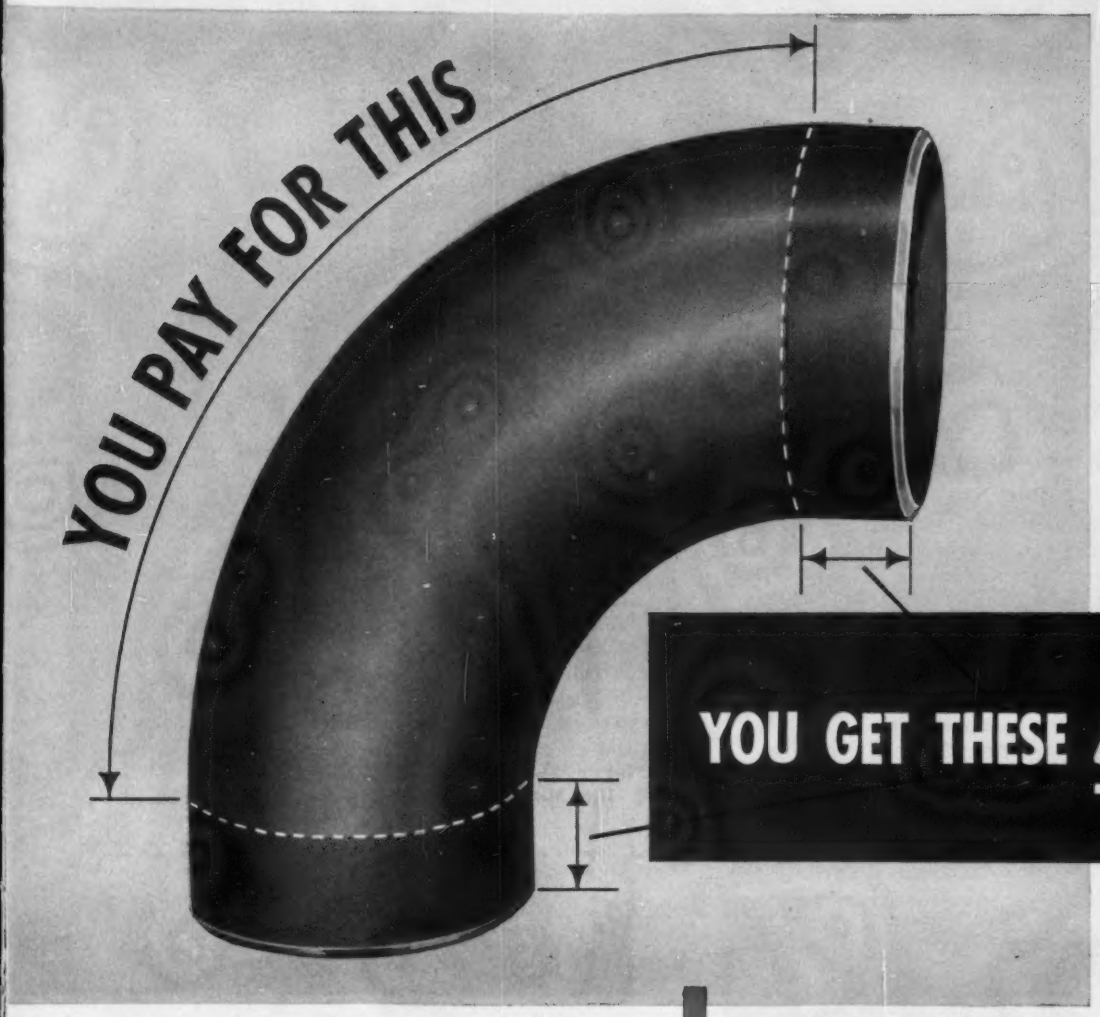
Manufacturer states that unit is equally well suited to processes where power is required and where exhaust energy can also be used for pre-heating or for steam generation.

The turbine is designed for normal operation at an inlet temperature of 1340 F. The design permits full load within two minutes of initiating starting cycle.

The complete unit weighs approximately six tons. Normally furnished with one-piece base, the unit can also be furnished with a two-piece base making it easily airborne or transported where weight or size is a problem. Three-point support assures proper alignment. Additional information is available on request to the manufacturer.

Clark Bros Company, Olean, New York

MIDWEST "LONG TANGENT" ELBOWS



In no other welding elbow do you get this "bonus" of long tangents. The dotted lines show where standard elbows end. Each shaded straight end equals ¼ of the nominal fitting diameter . . . a 12" Midwest "Long Tangent" Elbow has tangents 3" long. As a result of the advantages listed at the right, substantial savings are made on many piping systems by using Midwest "Long Tangent" Elbows . . . which cost no more than other elbows. For further information, write for Catalog 54.

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ADVANTAGES OF MIDWEST "LONG TANGENT" ELBOWS

- ★ They save pipe.
- ★ They often eliminate short nipples and their extra welds.
- ★ They save time and money in lining up and clamping pipe and fitting.
- ★ They make it easier to apply slip-on flanges.
- ★ They remove the circumferential weld from point of maximum stress and can be sleeved.
- ★ THEY COST NO MORE THAN OTHER ELBOWS

MIDWEST HAS THE MOST COMPLETE LINE

7325

MIDWEST WELDING FITTINGS IMPROVE PIPING DESIGN AND REDUCE COSTS

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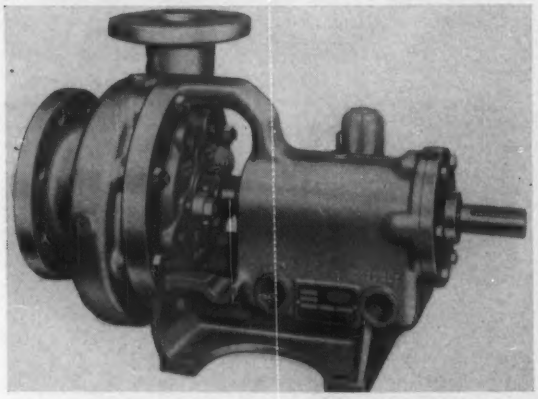
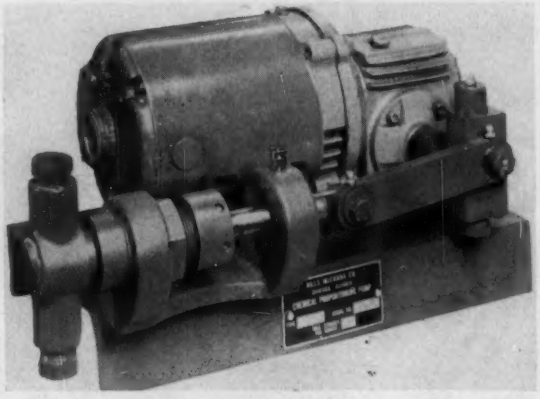


Pumps handle most process liquids

1003 • *Types DL* and *DM* pumps are designed for pumping most chemical process liquids, either hot or cold, in moderate capacities against low, medium or high heads. Manufacturer places special emphasis on complete interchangeability of pump components.

Sizes from 1 through 4 in. are offered in either enclosed or open-impeller design. Capacities to 800 gpm are provided and the unit will operate against heads to 400 ft. Driver can be a standard, horizontal electric motor mounted on a common base with pump. *Type DL* is a grease-lubricated unit; *Type DM* is oil lubricated.

Peerless Pump Div, Food Machinery and Chemical Corp, 301 West Ave 26, Los Angeles 31, Calif.



Chemical feed pump is self priming

1004 • Pump, for metering chemicals in water conditioning, waste treatment and product processing, delivers up to 7 gph/feed at discharge pressures to 600 psi.

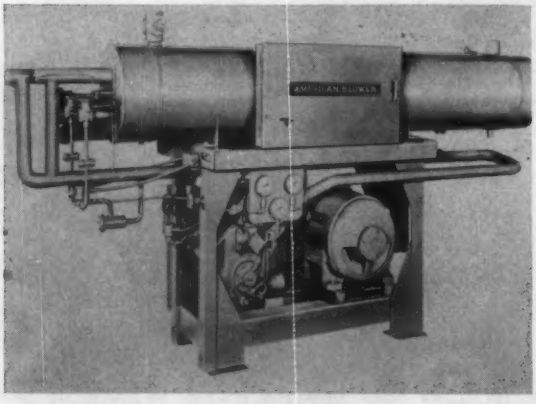
Maintenance is simplified since only two assemblies are needed to completely replace reagent end.

Maximum stroke length is 1½ in. Manual adjustment of plunger stroke length provides 0 to 100% adjustment, permits full range of capacity adjustment.

Standard drive is a 1/6-hp 115-v, single-phase 60-cycle gear motor with open enclosure. Yoke-type design of check-valve assembly to reagent end eliminates air binding, makes the pump self-priming.

Hills-McCanna Co, 2369 W Nelson St, Chicago 18, Ill.

For more data on these items, use post cards page 165. Identify your request with item number.

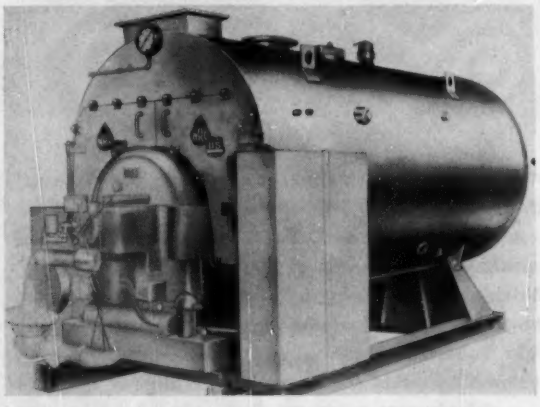


Water chillers for industrial use

1005 • Packaged water chillers are available in capacities from 20 through 250 tons. Each unit consists of base and framework, reciprocating-type Freon-22 compressor, direct-expansion chiller section, heat exchangers, control panel, electric drive motor and associated valves, strainers and gages. Across-the-line magnetic motor starters are standard equipment.

Copper tubing with aluminum insert is claimed to have more than doubled the heat-transfer surface of plain tubing, adding to unit's cooling capacity.

American Blower Corporation, Detroit 32, Mich.



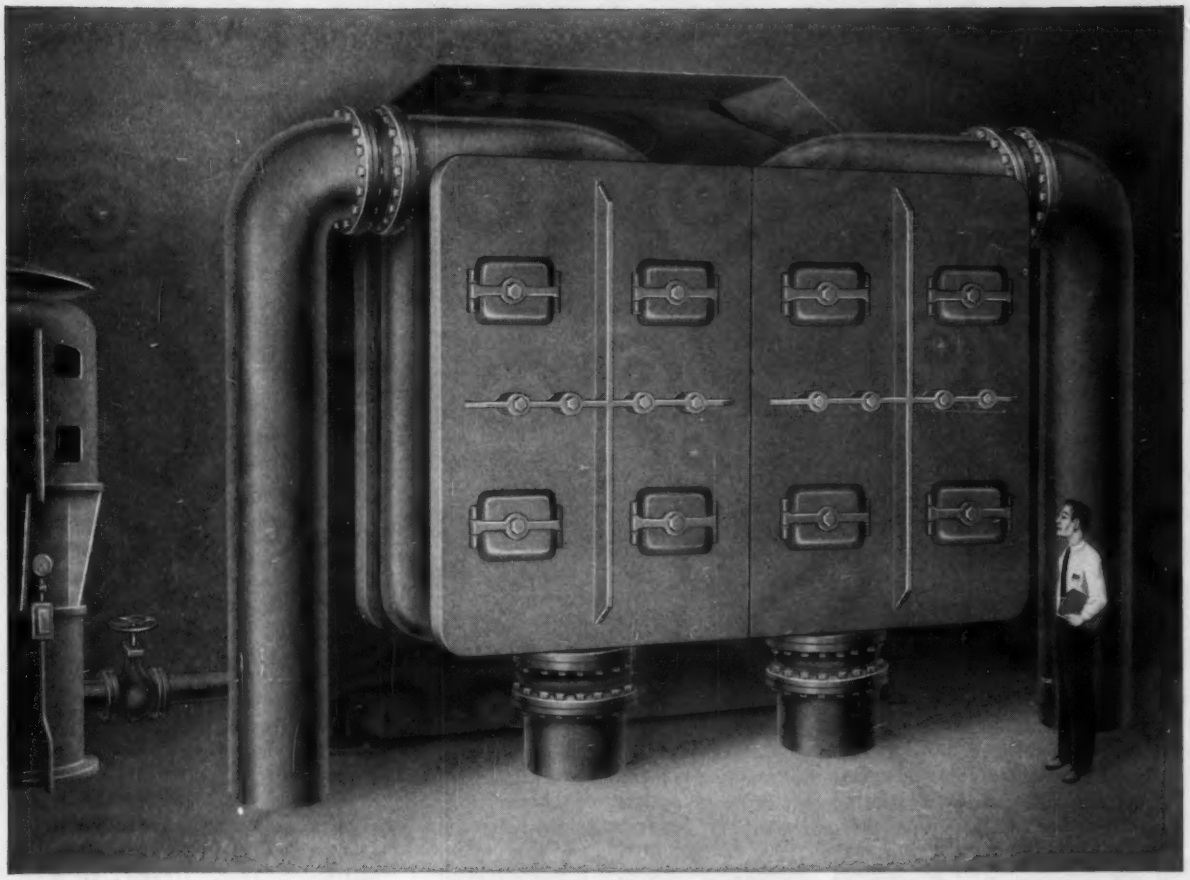
Boilers feature wet-back design

1006 • *Type SN* boilers are for use with commercial-sized oil or gas burners using natural draft. Net SBI steam ratings are 4500 to 35,000 sq ft and SBI net water ratings extend from 7200 to 56,000 sq ft.

Type SF boilers are used for forced-draft oil, gas or gas-oil firing. These have net steam ratings extending from 6400 to 50,000 sq ft and net water ratings of 10,300 to 80,000 sq ft.

Wet-back design assures rear combustion chamber being surrounded by water-backed heating surface.

National-U.S. Radiator Corp, Johnstown, Pa.



"Maryland's" Industrial Products Division has broad experience in the manufacture of condensers ranging from 515 to 100,000 square feet. Illustrated is a 17,000 square foot condenser designed by Marind.

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More EQUIPMENT NEWS

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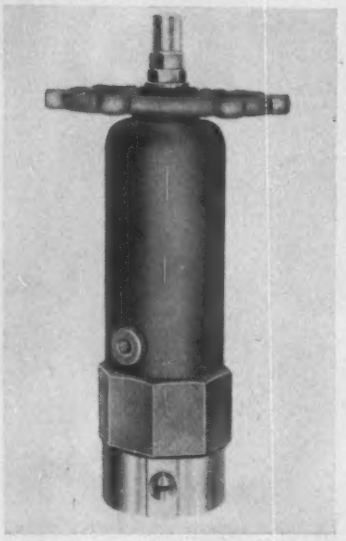
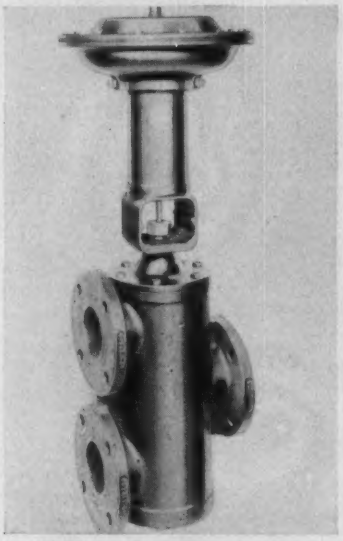


Adjustable-control valve

1007 • Combination pressure-reducing and relief valve for air, gas, oil or water service operates on initial pressures to 4000 psi. Unit features adjustable control pressures that can vary up or down by as little as 2 psi over a range as wide as 0 to 2500 psi.

The valve has no external actuating connections and is built without a stuffing box. It may be installed directly in the pipeline.

Atlas Valve Company, 280 South St, Newark 5, N. J.

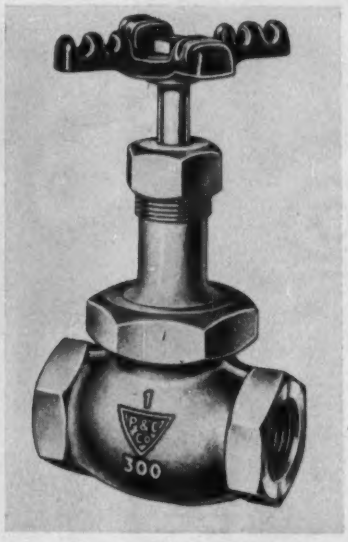


Three-way by-pass valves

1008 • Units are designed for accurate control of liquid flow. Manufacturer states that total capacity of valves is constant, regardless of position of the inner valve. Flow can be directed to either of two outlets. Maximum pressures range to 250 psi at 406 F and 400 psi at 70 F.

Tight-closing feature is claimed to make units ideal for diverting applications that would ordinarily require use of two separate valves.

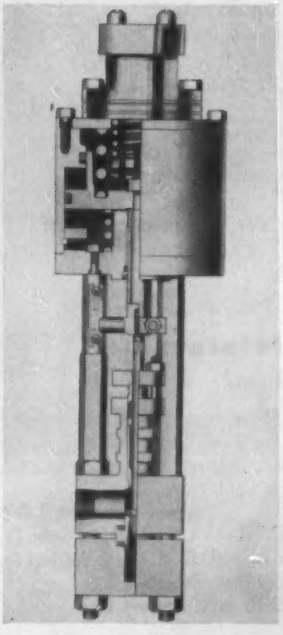
Johnson Service Company, Milwaukee 1, Wis.



Bronze globe valve

1009 • This valve is recommended for industrial applications of steam, water, oil and gas service where continuous control or regulation of control is required. Manufacturer claims that the device is particularly effective for frequent or continuous throttling and other severe applications. Valve is rated for 300-lb steam at 550 F maximum—1000-lb OWG in ½ to 2 in. sizes and 600-lb OWG in 2½ and 3 in. sizes.

R-P&C Valve Div, American Chain & Cable Co, Inc, Reading, Pa.



Small flow-control valves for pressures to 6000 psi

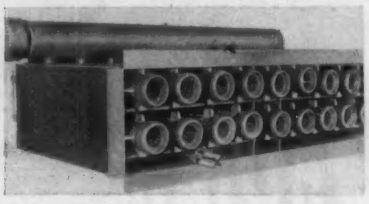
1010 • Manufacturer claims that this series of valves, designed for working pressures to 6000 psi, will provide industry, research and pilot-plant engineers with a high-speed and responsive small flow-control valve. Differential area piston eliminates need for loading regulator and will stroke fully in either direction in .75 seconds or less, according to manufacturer.

Offset globe or angle bodies have body sections that rotate in 90-degree increments for piping convenience. Further information obtainable on request to the manufacturer.

The Annin Co, 6570 E Telegraph Rd, Los Angeles 22, Calif.

For details on these items use post cards p 165. Identify request with item number.

Be sure to check this item . . .



Inshot gas burner . . . . . p 194

. . . and these and the many others appearing on pages noted below:

Telescoping bag conveyor . . . . . p 196
Fire-resistant compound . . . . . p 198
Flexible vinyl tubing . . . . . p 200
Shock column vibrator . . . . . p 204
Industrial roof ventilator . . . . . p 205
Liquid level gage . . . . . p 208
Eyesaver slide rules . . . . . p 210

"Used many makes of turbines... PREFERS COPPUS"

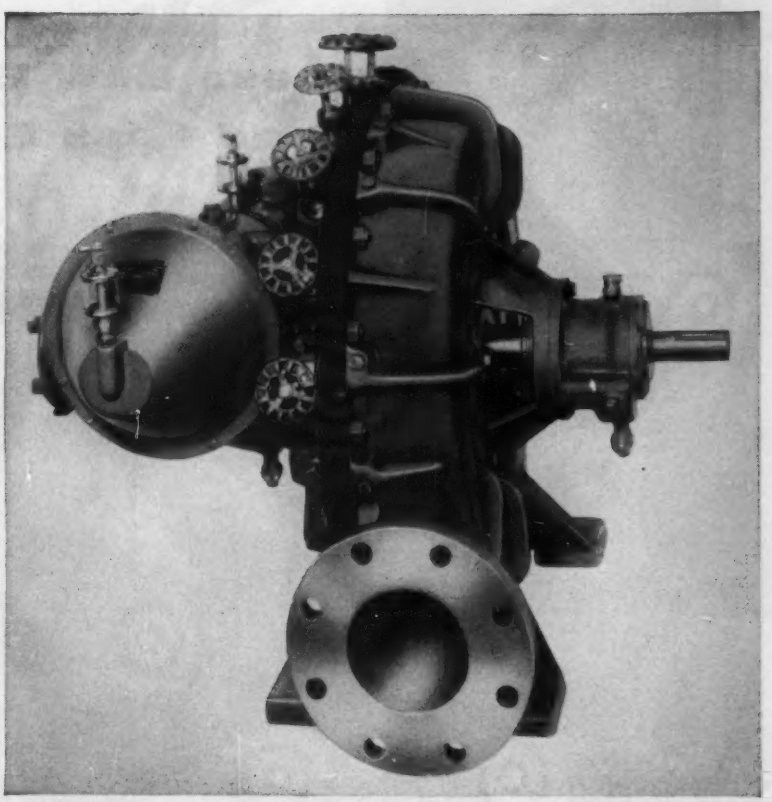
If you want to know about turbine performance, ask an *operator*. He *knows*. And, in the words of one of them:

> "I have had occasion in the past to operate many makes of turbines. The plant in which I am now employed is almost entirely Coppus equipped on our auxiliary equipment. I find your turbines most satisfactory and would like to congratulate you on your design."

Whether you use a Coppus with a regular wheel or wide bucket "L" type you get these *proven* features:

- Turbines rated close to your hp requirements from 150 hp down to fractional. No need to buy a bigger, costlier turbine than your conditions call for.
- A larger number of steam nozzles, controlled individually by manually operated valves.
- Exclusive pilot operated excess speed safety trip supplementing constant speed governor.
- Replaceable cartridge type bearing housings.
- Optional carbon ring packing glands.
- Coppus Steam Turbines ranging from 150 hp down to fractional in 6 frame sizes, *make turbine dollars go farther*. Send for Bulletin 135 on Coppus Turbine.

COPPUS ENGINEERING CORPORATION
170 Park Avenue, Worcester 2, Mass.
Sales offices in THOMAS' REGISTER

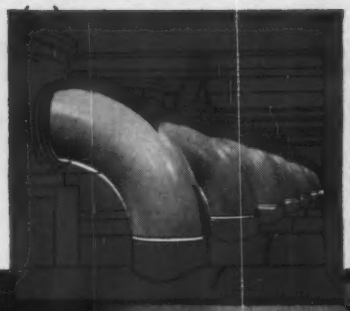


This is the reliable Coppus Turbine furnished with either a regular wheel or wide bucket "L" type wheel.

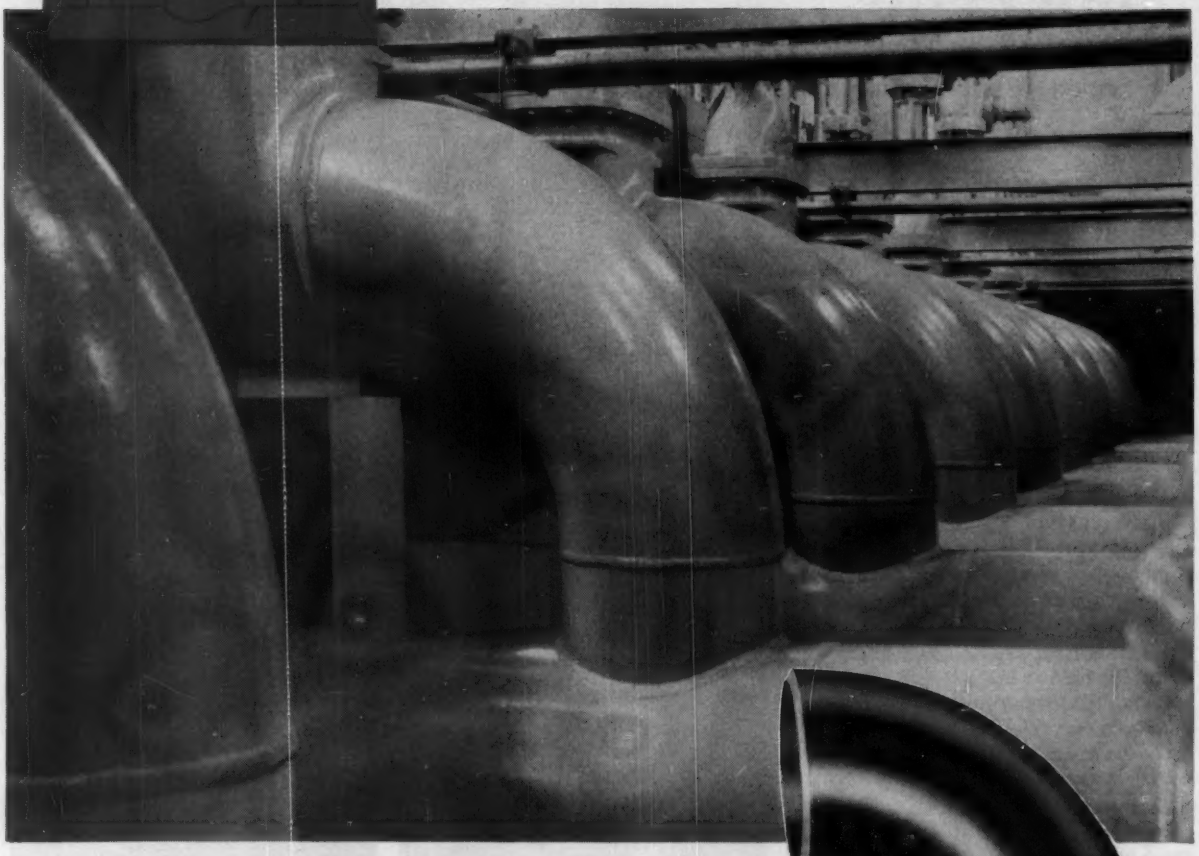
This wide bucket "L" type wheel is a new development for use where low water rate is essential

This is the regular wheel used on Coppus Turbines which have been so highly satisfactory throughout industry.

COPPUS "BLUE RIBBON" TURBINES



These B&W Elbows Need Less ELBOW ROOM



ELBOW room was at a premium in this piping manifold. Fabricators chose B&W Fittings because they're easy to install, especially in a job like this which calls for "close-quarter" welding. Installation went ahead fast and without trouble, thanks to the accurate dimensions of the B&W Welding Ells used.

Maintenance, too, will be kept at a minimum because, with a sound weld, piping is permanent and leakproof. B&W Seamless Welding Fittings and Flanges are available in a complete range of grades, types, sizes and pipe schedules.

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B&W TUBULAR PRODUCTS DIVISION

THE BABCOCK & WILCOX COMPANY
TUBULAR PRODUCTS DIVISION • FITTINGS DEPARTMENT
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AIR CONDITIONING, HEATING

1 **Diffusers.** Ceiling-panel units, straightline 100% aspiration diffuser, high-capacity vane-type unit for high sidewall installation, diffusers for ceiling mounting with center induction and radial distribution, and diffusers with air extraction in the outer cones, are included in 12-p bulletin. Contains performance charts, photos, drawings. Anemostat Corp of America, New York, N. Y.

★ **Heating elements** for electric furnaces and kilns are given case-history treatment in 7-p illustrated brochure. ★Request "Leading manufacturers report saving with 'hot rods,'" on company letterhead, direct from Norton Co, Worcester 6, Mass.

2 **Hot-water heater** is subject of 11-p illustrated bulletin. Contains specs, capacity table, applications, operating requirements and engineering data. Pick Mfg Co, West Bend, Wis.

3 **Packaged water chillers** for air conditioning or industrial cooling applications are described in illustrated bulletin 5925. Includes description of mechanical specs for all sub-assemblies and components. Chiller-element construction details are discussed. American Blower Corp, Detroit 32, Mich.

BOILERS AND AUXILIARIES

4 **Refractory cement,** *Super ₤3000,* a heavy duty bonding and patching mortar, is described in 8-p illustrated folder. Includes information on applications in high-temperature work and in protection of equipment against slag, flyash and gases. Refractory & Insulation Corp, 120 Wall St, New York 5, N. Y.

5 **Refractory products** are described in 4-p catalog 200. Contains 15 illustrations, seven technical data tables on firebrick, refractory castables, insulating castables, special cast-tables, high-temperature mortars, plastic firebrick and special refractory products. J H France Refractories Co, 3152 France Road, Snow Shoe, Pa.

6 **Package boiler** is subject of 18-p illustrated bulletin. Discusses typical installations. Includes dimension sheet, engineering data and info on selection of fuel, firing equipment and accessories. Dominion Bridge Co, Ltd, Box 280, Lachine, Que.

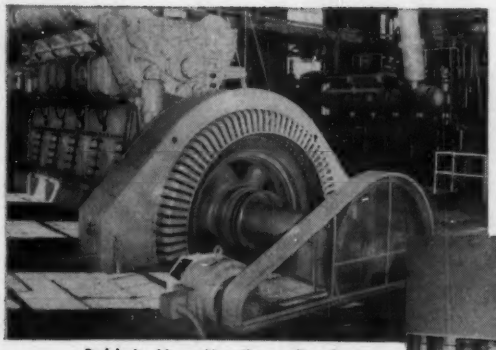
COMPRESSORS AND ACCESSORIES

7 **Belt-driven compressors.** Four-cylinder high-speed units are discussed in 4-page booklet. Contains illustrated service instructions which cover replacement of valve plates, seal assembly and oil pump. Copeland Refrigeration Corp, Sidney, Ohio. (*Continued on page* 224)

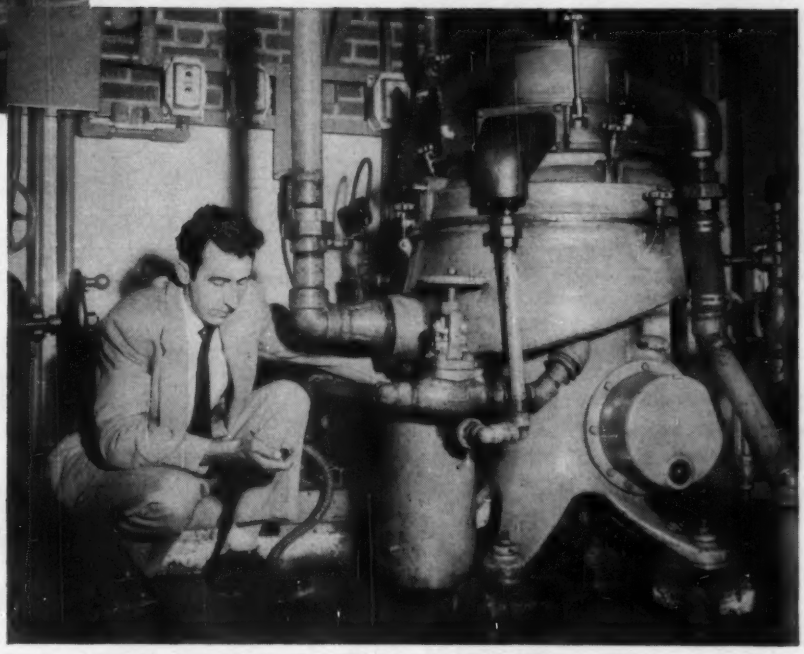
DE LAVAL AC-VO CENTRIFUGE SAVES EDMUNDSTON $30,638 IN ONE YEAR!

The City of Edmundston power plant in New Brunswick adds another story of tremendous savings through the use of residual fuel—purified by De Laval.

With #2 diesel fuel costing 15½¢, and residual 9¼¢ per gallon... there is a gross savings of 6¼¢ per gallon when residual fuel is used. Mr. L. Long, Electrical Superintendent says: "A total of 490,216 gallons of #6 fuel was burned from May 1, 1955 to May 1, 1956. *Gross savings amounted to $30,638.50.*



Baldwin-Lima-Hamilton diesel engine at City of Edmundston power plant in New Brunswick.



De Laval AC-VO "Nozzle-Matic" Continuous Purifier at City of Edmundston plant.

Mr. Long says "the De Laval AC-VO removed some 5,280 gallons of sludge. The engine operated 4912 hrs. on heavy fuel. A thorough inspection showed that fuel injection equipment, bearings, gears, etc., were in excellent condition."

Get tremendous savings with low-cost heavy fuel oil—*purified by De Laval!* Write for details... today!

DE LAVAL SEPARATOR COMPANY

THE DE LAVAL SEPARATOR COMPANY Poughkeepsie, New York • 427 Randolph St., Chicago 6 • DE LAVAL PACIFIC CO. 201 E. Millbrae Ave., Millbrae, Calif.

George Edwards

asks, "Do you judge a book by its cover?"

► SINCE TELLING YOU about Ed Pritchard (March 1956) I've gotten a number of letters from POWER readers about men they've known who were 'just like Ed.' I enjoyed the letters and, reading between the lines, couldn't help sensing the writers' belief in the 'brother's-keeper' philosophy. The quality they admired in other men.

One letter struck a different note—something to think about. I'd like to quote part of it:

"I had to go to work before I finished high school. After a year as a pipe-fitter's helper, it became plain that without more education, I was a dead duck. I started struggling through a correspondence course in high-school subjects. I studied every chance I got—even on the bus to and from work.

"One of the regular morning passengers was a guy that had 'stuffed shirt' stamped all over him. He looked like he was afraid he'd be contaminated if a common workman got near him. Just looking at him irritated me and I never could bring myself to sit down beside him.

"One morning I had no choice. It was the only vacant seat and I couldn't do my schoolwork standing up. To make it worse, this happened several mornings in a row.

"The third morning, apparently watching me battle with an algebraic equation, he leaned over and gave me a little hint. I had a tough time associating the gentle voice with the way he looked. Within a week we were friends. I told him all about myself; learned he was an electrical engineer with a small business in a nearby town.

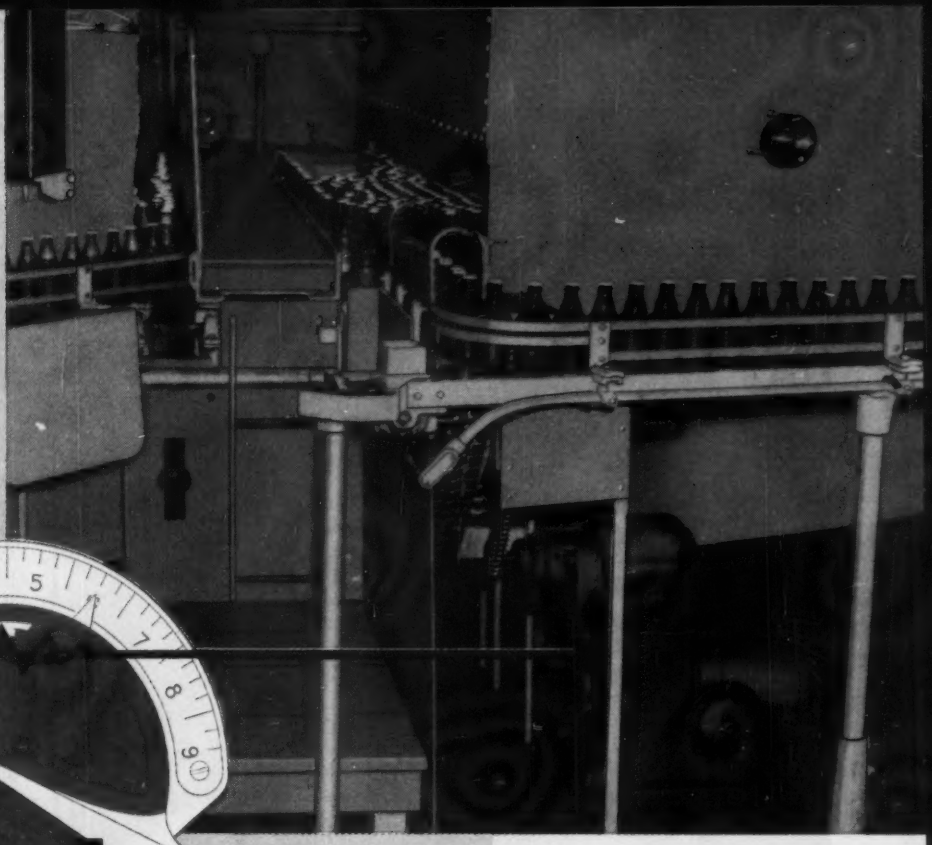
"I couldn't wait to get on the bus each morning. He made sure I did my own thinking, but I'd never have finished that course without him.

"I got my diploma. Then, with his advice, started a night-school degree course. We continued to ride the bus together. Aside from talking shop and about my school progress, he opened my eyes to a lot of things. Gave me books to read, told me of others I should read. I learned from him that education and intelligence don't necessarily mean the same thing.

"Through the years, I've often thought of how different my life would be if I had just kept on being *irritated by this person* and never had had a chance to *see the man*. It isn't likely the pipe-fitter's helper would now be the plant's senior electrical engineer.

"I've often wondered, too, how many of us deny ourselves real opportunities in life because we're too prone to measure others by visual yardsticks alone."

VARIABLE SPEEDS FOR VARYING NEEDS...

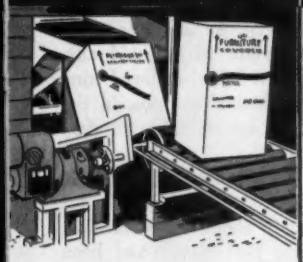


Control conveyor speeds with U.S. VARIDRIVES

NOW FAST, NOW SLOW THE BOTTLES GO

Two U. S. Varidrive motors provide the answer to the problem of varying the speed of the circular rotating table and conveyor for this pasteurizer. The use of Varidrives eliminates adjustment troubles and gives the operator accurate control of the conveyor and table, to suit filler or labeler capacity. Varidrives give added versatility to conveyors in all types of industry. Varidrives are available from ¼ to 60 h.p. Speeds 2 to 10,000 rpm.

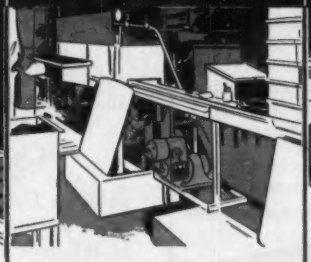
URNITURE CONVEYOR



VARIDRIVE "SETS" THE TEMPO

As loading and packaging requirements vary, a fractional horsepower Varidrive provides just the right speed for this furniture conveyor.

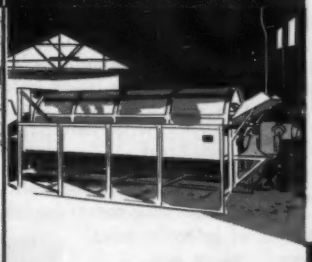
TILE GLAZING



A "CHANGE OF PACE" WITH CONTROL

Since tile glazing time varies, conveyor speeds must also vary. This VA Totally-Enclosed Varidrive powers the tile conveyor at the proper speed for best results.

FOOD INDUSTRY



JUST "SAY WHEN"

In this application a U. S. Varidrive provides maximum production by coordinating the washing operation with the volume of carrots entering the tumbler.

Versatile VARIDRIVE for additional applications:

PUMPING	SPOOLING
PUNCH PRESSES	MIXING & BLENDING
LATHES	CANNING
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PACKAGING	VENTILATION
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U.S. Electrical MOTORS

MAIL COUPON NOW

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P. O. Box 2058, Los Angeles 54, Calif. or Milford, Conn.
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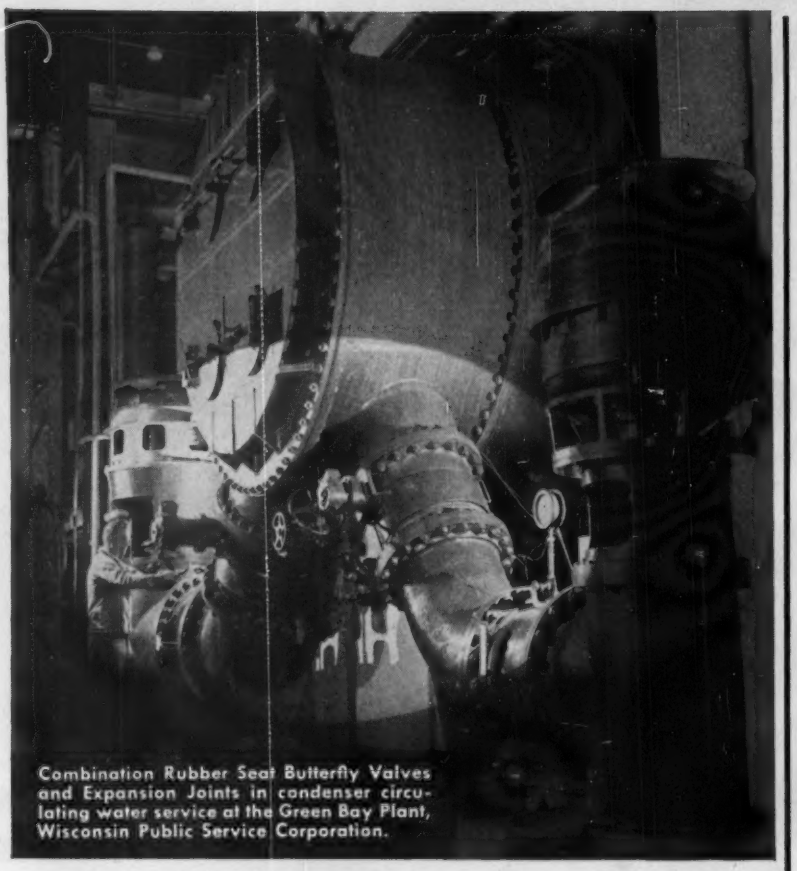

Combination Rubber Seat Butterfly Valves and Expansion Joints in condenser circulating water service at the Green Bay Plant, Wisconsin Public Service Corporation.

GREEN BAY... Combines Butterfly Valves with expansion joints for new economy

Drop-tight shutoff, plus provision for pipeline expansion and ease of assembly are provided here in one compact Pratt unit. By combining the Butterfly Valve with the expansion joint, space requirements are minimized and maintenance (and initial cost) of one set of flanges and bolts is eliminated. This is a typical Henry Pratt engineering job—the mechanisms are the simplest available . . . for economy and minimum maintenance, and they are carefully designed and built for peak efficiency and operating ease.

Henry Pratt pioneered the use of Rubber Seat Butterfly Valves in power plants. Combined with permanently drop-tight shutoff, the inherent simplicity and compactness of this valve permitted a new concept of large-diameter valving by power plant engineers.

Pratt Rubber Seat Butterfly Valves grew with the Power Industry for thirty years, and today are being installed in modern, nuclear power plants. For valve design—with **imagination**—see Henry Pratt.

NEW! Latest, most accurate pressure drop and flow data, conversion tables, discussion of butterfly valve theory and application plus other technical information.

Write for Manual B-2K

HENRY PRATT

RUBBER SEAT

Butterfly Valves

Henry Pratt Company, 2222 S. Halsted St., Chicago 8, Ill. Representatives in principal cities

MARMADUKE

Continued from page 144

for the Second's farm down the Missippi, near Memphis.

"One evening, after a week of fishing and squirrel hunting, I drove into town to look for excitement. While ballasting my tanks at the Goldenrod Café, I ran into a loud-mouthed operating engineer. He broadcast that he was chief of the local brewery, just opened up with repeal of prohibition. After sounding off about his big operation, he suddenly offered me a shift engineer's job. I had planned on shipping down river to the Gulf the following week, but decided to stick around long enough to learn something from that character.

"The plant had been shut down since 1919. It had two ancient slow-speed corliss engines. Each engine drove a vertical ammonia compressor from its crankshaft. Steam was generated by two watertube boilers that had been converted from coal to heavy oil a few weeks before. Automatic combustion-control system had also been installed. I learned that the brewery was the chief's first oil-burning job. Fact is, he had learned most of his operating in a small ice plant inland.

"I started on the graveyard shift the evening after meeting the chief. On taking over my first watch, my hillbilly fireman told me he had heard that the 4 to 12 shift had had an explosion in No. 1 boiler while blowing tubes. He raved, 'All hell broke loose when they worked the bottom rear soot blower. The explosion doors flew open and flames and soot shot out with a bang. We gotta be careful blowing that boiler, she's plenty ornery,' he cautioned. But the 4 to 12 operator hadn't said anything to me when I had relieved him. And I couldn't find a notation in the log book—if you could call what they kept a log book.

"Tubes were blown each watch, which at least was something. When I asked my fireman about that explosion, he informed me that No. 1 had been 'acting up' but that was the first time she had really flipped her lid. That got me to thinking.

"I had a lot to do that first watch. Besides, the steamfitters and electricians had the plant torn up from stem to stern. But later that shift, when we were ready to blow tubes, I took a few precautions. First, I cut out the automatic and put her on manual while I had my fireman drain and warm up the soot blowers. When he was ready, I cut the burners back to about one-quarter capacity. Then I opened the air registers and peep holes. As the element revolved slowly, I could see

There's more in this barrel for you...

James E. Pratt, left, Socony Mobil engineer, obtains performance data on hydraulic system at an aluminum extrusion plant.

MORE ENGINEERS

to help you improve production and cut costs!

Specify Socony Mobil and get the services of more industrial lubrication engineers than are provided by any other oil company.

These specialists, working closely with your Mobil representative, will help you set up a plant-wide program of correct lubrication . . . advise on any lubrication problems that might arise. Their long experience and expert recommendations can improve your production and cut costs.

Socony Mobil products are also backed by *more* services for analyzing petroleum products in use . . . *more* on-the-job training of your personnel in correct product application . . . *more* approvals from machine builders . . . *more* continuous research to assure continually improved products . . . *more* practical experience—90 years!

Always specify Socony Mobil. There's *more* in every barrel for you!

SPECIFY **SOCONY MOBIL** FIRST STEP IN CUTTING COSTS

SOCONY MOBIL OIL CO., INC., and Affiliates: MAGNOLIA PETROLEUM COMPANY
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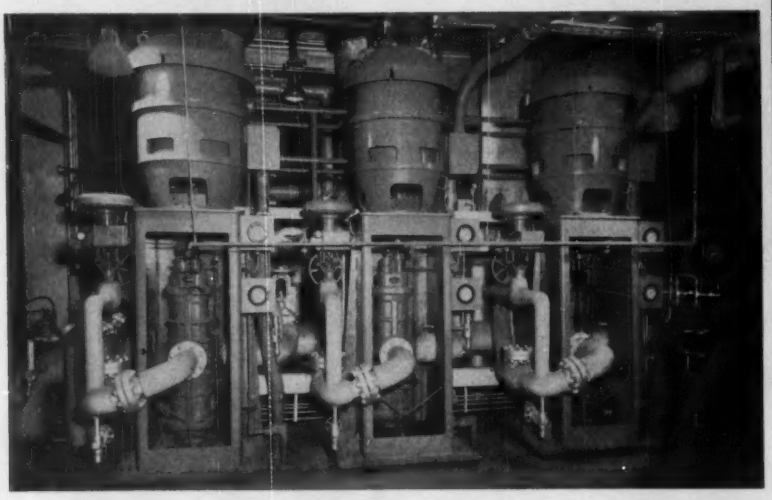
WARREN-QUIMBY SCREW PUMPS USED in the PROCESS of GENERATING STEAM for the WORLD'S TWO HIGHEST TEMPERATURE STEAM TURBINES at

Public Service Electric and Gas Company



ENGINEERING progress marches on and the installation of two of the world's first 1100°F. steam turbines at the new Kearny Station of Public Service Electric and Gas Company in New Jersey, marks another important advancement. Two 145,000 kw. reheat units have initial temperature of 1100°F., pressure of 2350 psig, and reheat temperature of 1050°F. Utilizing these advanced steam conditions results in definitely lower generating costs.

Three Warren-Quimby Gear-in-Head, Vertical Screw Pumps were selected for fuel oil service in connection with this important installation. These pumps are of cast steel with center bearing, and handle Bunker "C" fuel oil at an operating temperature of 125 to 135°F.; viscosity 1500 to 2500 S. S. U.; capacity, 180 g.p.m.; 1150 r.p.m.; suction pressure, 20″ Hg. lift; discharge pressure 775 psig.

Keep in step with progress . . . specify: WARREN QUIMBY PUMPS

WARREN PUMPS

WARREN STEAM PUMP COMPANY, INC.

Warren, Massachusetts

MARMADUKE

Continued from page 170

the jets of steam coming out of some of the blower nozzles. It didn't take long to find what I was looking for. Just as I thought, the steam was blowing down against the flame and draft, instead of sweeping the tubes. Looked to me like that sudden blast of steam against the flame smothered it. Then after swinging past the flame area, the oil would ignite with an explosion off the hot furnace walls.

"I had my fireman revolve the soot blower only halfway, then sweep her back and forth, making sure he didn't pass the halfway mark. He gave those tubes a good blow in that way. We didn't have an explosion. The steam pressure dropped about 40 psi while blowing tubes, but I had no trouble picking up the load again in a short time.

"Aboard ship I would have reset that soot blower without asking questions, but a lot of things went haywire that first shift. Besides, I'd run into some queer chiefs in shore plants so I let the soot blower alone.

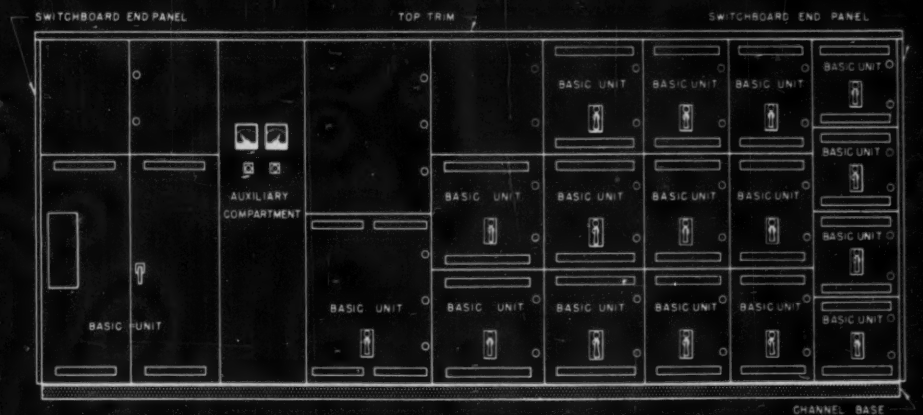
"Before going off watch I did tell my relief what was wrong. But he was an ex-truckdriver and that was his first job as an operator. He knew automobile engines, but not much about boilers. I also left a note on the chief's desk. But next watch that soot blower still wasn't adjusted.

"Well, in about two days it happened again; and again on the 4 to 12 shift. This time the watch engineer was standing near a puff door and was badly burned about the face and arms. The boiler had a lot of insulation jarred from its top. That night, shortly after I took over, the chief showed up at the plant. It was a good thing he did because I was getting fed up with blowing tubes by swinging the sweeps only halfway. I wanted to see what he was going to do about it since I had told him what was wrong.

" 'How come you ain't blowing tubes like the rest of the operators?' he asked, fixing his running lights on me. I told him I had left a note on his desk, telling him exactly what was wrong with that boiler—and that we had been blowing tubes every shift and logging it. But he passed that off without answering. Finally I started catching on. I figured he didn't know how to make that adjustment—and neither did anyone else, so he acted like he hadn't received my note.

"Finally he came out with it. 'Well,' he began, scratching his chin, 'Suppose you adjust that soot blower. But mind you,' he cautioned, 'I don't want the office raising hell with me for you tak-

I-T-E Low Voltage Switchgear



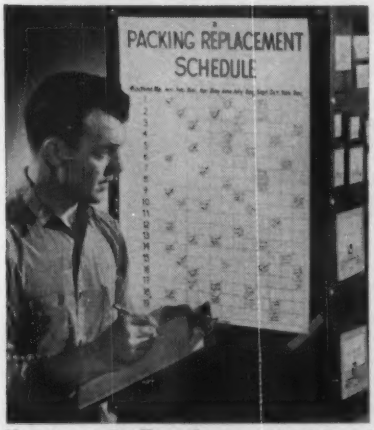
--the finest of modern switchgear factory assembled, shipped as a unit, ready to install in your plant

I-T-E Low Voltage Switchgear provides the optimum in dependability, safety, reduced maintenance costs, and attractive appearance. I-T-E Circuit Breakers have proved their worth in thousands of applications. I-T-E Structures are designed specifically to house and interconnect these time-proved protective devices and auxiliary equipment. When you combine the two, you have the finest of circuit breakers in the finest of structures. And you get the additional advantages of less special engineering, faster delivery, and units custom-made in standard frames to fit your requirements.

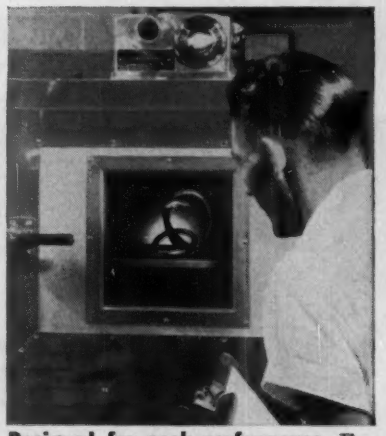
For complete information, consult your nearest I-T-E sales office. Or write I-T-E Circuit Breaker Company, 19th & Hamilton Sts., Philadelphia 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY • Switchgear Division

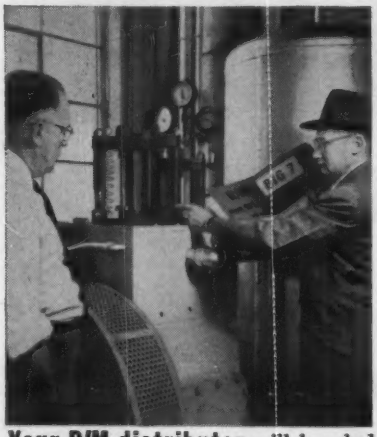
With R/M's Big 7 Packing Types you can reduce downtime tremendously



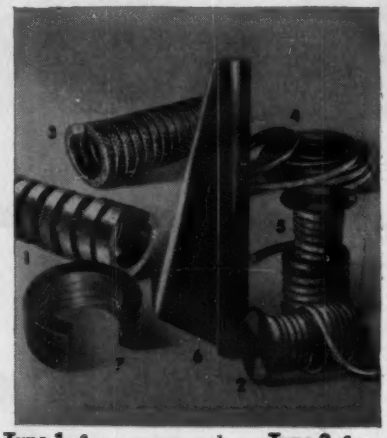
You can actually set up a schedule of preventive rather than corrective maintenance with R/M's Big 7 Packing Types. Their custom-built construction will give you superlative performance, reducing downtime and maintenance costs. Only 3 or 4 types are normally required in most plants.



Designed for peak performance. For example, R/M Type 2 packings for valve stems and expansion joints take up to 1000°F. Made of high asbestos content yarn, they will not burn like packings with high organic content. Also, lubricants are "ground in"—stay in for life.



Your R/M distributor will be glad to show you how you can easily reduce downtime and costs, lower inventories, and simplify ordering by making the custom-built Big 7 line of packings standard in your plant. All R/M packings for maintenance are sold only through authorized R/M distributors.



Type 1, for pumps, valves; **Type 2,** for high temperature valve stems, expansion joints; **Type 3,** for high speed rotary air compressors; **Type 4,** for corrosives, acids, viscous materials; **Type 5,** "Teflon"* for chemicals; **Type 6,** gasket materials; **Type 7,** for hydraulic and pneumatic equipment.

*Du Pont trademark

R/M'S BIG 7 PACKING TYPES MEET 95% OF ALL PACKING NEEDS

R/M

BIG 7 PACKINGS
RAYBESTOS-MANHATTAN, INC.
PACKING DIVISION, PASSAIC, N.J.
MECHANICAL PACKINGS AND GASKET MATERIALS

FACTORIES: Bridgeport, Conn.; Manheim, Pa.; No. Charleston, S.C.; Passaic, N.J.; Crawfordsville, Ind.; Neenah, Wis. Peterborough, Ontario, Canada.

RAYBESTOS-MANHATTAN, INC., Packings • Asbestos Textiles • Industrial Rubber, Engineered Plastic, and Sintered Metal Products • Abrasive and Diamond Wheels • Rubber Covered Equipment • Brake Linings • Brake Blocks • Clutch Facings • Fan Belts • Radiator Hose • Laundry Pads and Covers • Bowling Balls

MARMADUKE

Continued from page 172

ing that boiler off the line. If anything goes wrong you gotta take the blame yourself.'

"I laughed in his face, but felt sorry for him. 'So that's what's been eating on you,' I said. 'I'll fix that soot blower tonight and I don't have to take the boiler off the line.'

"A few hours later we started blowing tubes. But when my fireman revolved the sweep so the nozzles came into view through the peephole, I had him stop. Then I marked the element and loosened the bolts that held it to the chain wheel. Next, I held a Stillson wrench on the element and had my fireman revolve the wheel through its sweep while I kept the element from turning. Then I tightened the bolts real tight. We tried that element a few times. She worked OK. Her sweep was about 110 degrees and she wasn't bucking the flame and draft in the furnace.

Marmy stopped talking and started puffing away on his cigar butt. No one said a word. "And another thing," he blasted suddenly. "That proves a few things. One is that a mixture of wet steam, carbon and air, blowing against red-hot brickwork in a furnace, can be as dangerous as a lot of other boiler hazards. That's why I always check all soot blowers for proper arc of sweep when the boiler is down for overhaul or inspection. Usually nothing is wrong, but checking is good insurance anyway.

"Second point it proves is that as long as operators aren't interested enough in their profession to raise standards, you'll have people running expensive and dangerous equipment who should be in back of a plow.

"Third and most important," barked Marmy, standing up and heading for the door, "Not understanding something about your job isn't as bad as not having the guts to own up to it before someone gets hurt."—*SME*

LIKES STORIES

This month Marmy has been enjoyed by eleven persons in our office, as well as by my wife at home and myself. My father read the book of Marmy stories with a good deal of interest and enjoyment. To show his appreciation, he is forwarding a copy of his latest book for children, *John Rattling-Gourd* to Steve Elonka. I look forward to Marmy's monthly ramble. Or should I say rumble?

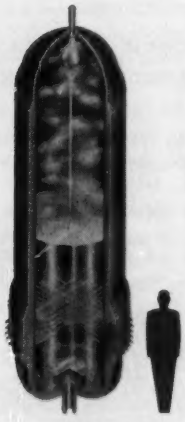
Too bad all of us in the engineering profession don't have a well rounded practical background like Marmy. His cold logic is down to earth.

C BELL *Knoxville, Tenn.*

Steam Generators by Foster Wheeler are

FIRST MAJOR COMPONENTS TO ARRIVE AT SHIPPINGPORT

World's First Full-Scale Atomic Power Plant will be served by two FW steam generators and a large FW pressurizer



Cutaway drawing of Foster Wheeler electrically heated pressurizer for Shippingport Power Plant

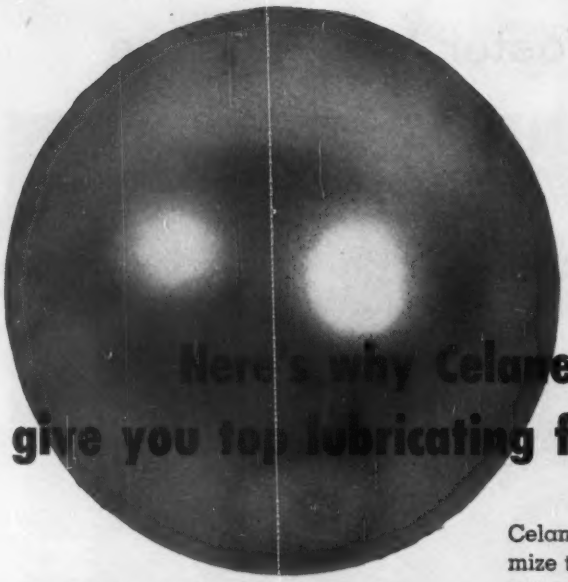
Scheduled for completion in 1957, Duquesne Light Company's Shippingport plant is making rapid progress in construction, as shown by the photograph above. The two FW steam generators for this atomic power plant were shipped right on schedule, and were the first major components to arrive at Shippingport. The steam generators will convert heat from the nuclear reactor into steam for operating the turbo-generator. The nuclear reactor is being built by Westinghouse Electric Corporation for the U. S. Atomic Energy Commission.

Also to be supplied by Foster Wheeler is the 18-ft high, 300 cu ft pressurizer shown in section at left. Used to control coolant loop pressure, it is designed for 2500 psig at 675 F. There are 342 electric immersion heaters to supply energy for initial raising of the coolant system, as well as to control pressure during operation.

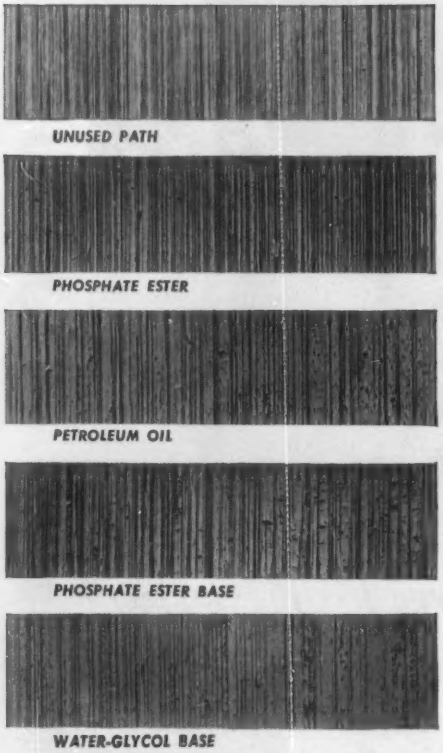
Foster Wheeler's nuclear know-how—in the design and construction of complete reactor systems or individual components—is available now, to assist in the planning of tomorrow's atomic power plants. For further information, write to *Foster Wheeler Corporation, 165 Broadway, New York 6, New York.*

FOSTER WHEELER

NEW YORK • LONDON • PARIS • ST. CATHARINES, ONT.



Here's why Celanese fire-resistant CELLULUBES give you top lubricating features



Photomicrographs of the surface of ball path of bearing operated in four hydraulic fluids: petroleum oil, phosphate ester, phosphate ester base, and water-glycol base. Fluids were evaluated on a transfer test machine where angular contact bearings were operated to point of failure. Of the combustion resistant fluids tested, the straight phosphate ester gave the longest bearing model life and the related ball path showed the least number of microscopic pits.[1]

Celanese Cellulubes are phosphate ester fluids designed to minimize the hazard of flash fires and explosions inherent in many industrial operations.

CONTAIN NO ADDITIVES

Because they contain no additives, Cellulubes give you excellent lubricating qualities, in addition to built-in fire-resistance. Just check these basic advantages offered by Cellulubes:

- **FIRE RESISTANCE—extremely high auto ignition point (over 1100° F.)**
- **LUBRICITY—excellent; low wear factor**
- **GRADED VISCOSITY—range of 6 controlled viscosities—90, 150, 220, 300, 500, and 1000 (S. U. S. @ 100° F.)**
- **STABILITY—unaffected by heat, wear or oxidants**
- **NON-CORROSIVE—in ferrous or non-ferrous systems**
- **NON-FOAMING—contain no additives; resist hydrolysis**
- **LONG-LIFE—chemically and physically stable**
- **MINIMUM MAINTENANCE—no viscosity adjustment required**

As air cylinder lubricants in compressed air systems, Cellulubes prevent the formation of excessive carbon deposits—the major cause of compressor fires. As hydraulic fluids, they reduce the danger of fires due to line breaks or other failures.

If you would like to evaluate Cellulubes in your own operation, use coupon below to order working samples and complete use data.

[1] From a report in *Lubrication Engineering*, July-Aug., 1956, entitled "A Study of Combustion Resistant Hydraulic Fluids as Ball Bearing Lubricants," by H. V. Cordiano, E. P. Cochran, Jr., and R. J. Wolfe.

Reprints of this article are available from Celanese Chemical Division on request.

EXPORT SALES: Amcel Company, Inc. and Pan Amcel Company, Inc., 180 Madison Avenue, New York 16, N. Y.

Celanese Corporation of America, Chemical Division, Dept. 597-J
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Celanese CHEMICALS

Cellulube® Celanese®

LARGEST FEED PUMP

Continued from page 103

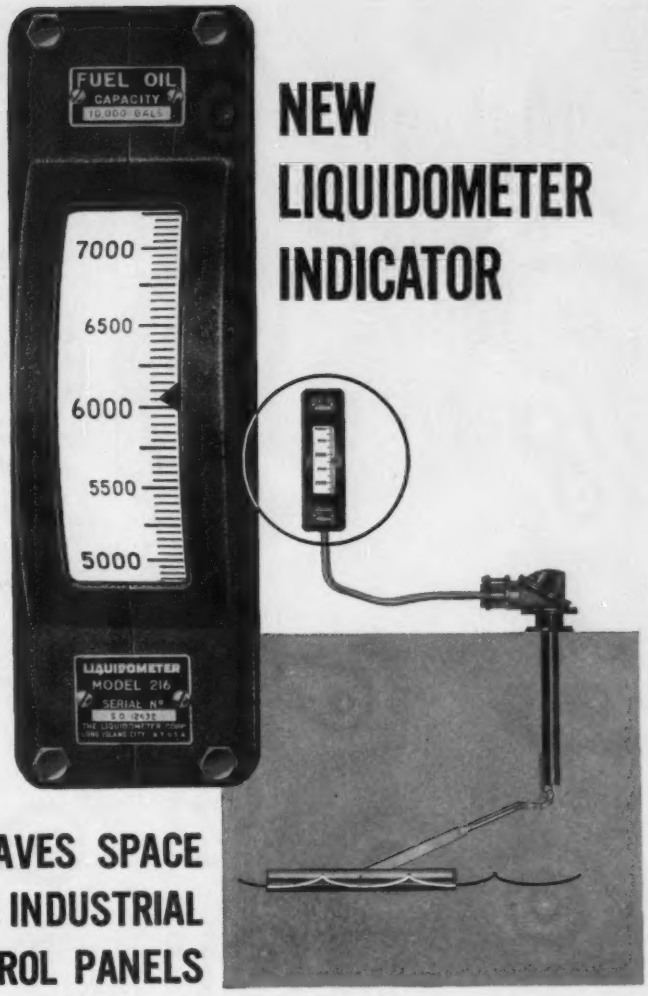
concern. Three likely arrangements, each with its advantages and disadvantages, were presented by Byron Jackson. First was a conventional stuffing-box arrangement with cage ring and packing surrounded by a water jacket. This would reduce leakage to a mininum, consistent with the temperatures and pressures involved. Second was a packed-type stuffing box arrangement —a good choice for reasonably low temperatures and pressures, but unsuitable for this particular installation because the conditions were beginning to reach the point where packing became somewhat of a problem. Successful operation with minimum leakage would cause accelerated sleeve and packing wear.

The basic disadvantage of a packed-type stuffing box is that it is subject to adjustment by an operator. Improper adjustment can result in excessive shaft-sleeve wear and subsequent shutdown for resleeving and repacking. Too loose an adjustment can result in excessive leakage, with subsequent requirements for drainage and collection of this leakoff. At the expected operating temperature, piping of cold water to and from the cage-ring connection to aid in cooling the shaft sleeve and packing would be required. Similarly, an in-and-out connection would be required for the water jacket, also a necessity at this temperature.

A more commonly accepted stuffing-box arrangement for the operating conditions involved would be the cold-injection - type throttle - bushing stuffing box. This construction is used where relatively high suction pressures and temperatures are encountered.

Cold condensate at slightly above suction pressure is injected near the inner end of throttle bushing, Fig. 4, p 103. Since injection pressure is slightly above suction pressure, a small amount of the injection water enters the pump from the inner end of the bushing while a greater amount is broken down to suction pressure as it travels between the bushing and sleeve toward the outer end of the pump. No cooling water is required since the condensate injection is cold.

Amount of leakage to the outside depends on the effective length of the bushing and the clearance between the bushing and sleeve. In this arrangement no packing is required, no adjustments are made and no attention is required on the part of the operator. As Fig. 4, p 103 shows, injection water surrounds the throttle bushing as it travels toward the injection point and in part acts as a water jacket which



NEW LIQUIDOMETER INDICATOR

SAVES SPACE ON INDUSTRIAL CONTROL PANELS

Twenty-inch dial in 3x10¼" case permits close readings

The new Liquidometer Model 216 Indicator gives the plant engineer a reliable, automatic reading of storage tank contents. Available in either vertical or horizontal design, the compact and highly readable Model 216 Indicator makes possible multiple installations on crowded control panels.

Teamed with Liquidometer's time-tested hydraulic transmission gaging system, the new indicator provides instantaneous remote indication of liquid levels—automatically. No outside power source is required. Virtually any liquid may be measured, and the indicator can be located up to 250 feet from the tank.

Engineered for dependability, the Liquidometer gaging systems highlight these design features:

- Maintenance free
- Integral temperature compensation
- Ease of installation—requires only one 2" diameter tank opening
- Safety—all gages Underwriters approved for hazardous liquids

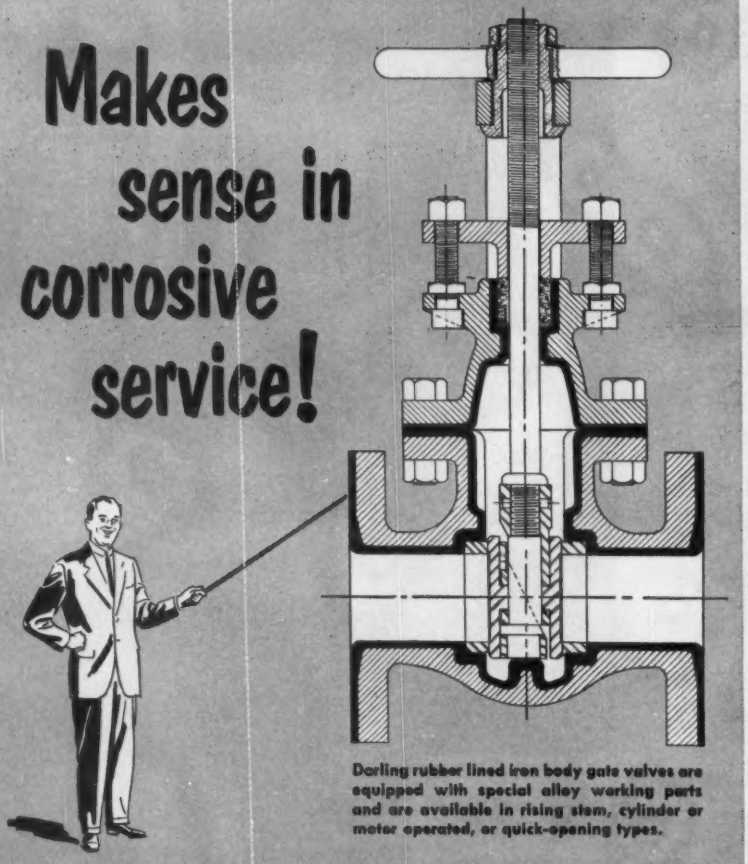
For further details on the new Model 216 Indicator, write Dept. E for Bulletin 532.

LIQUIDOMETER INSTRUMENTS

THE LIQUIDOMETER CORP.

SKILLMAN AVENUE AT 36th STREET
LONG ISLAND CITY 1, NEW YORK

Makes sense in corrosive service!



Darling rubber lined iron body gate valves are equipped with special alloy working parts and are available in rising stem, cylinder or motor operated, or quick-opening types.

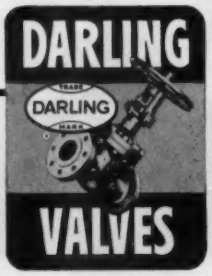
DARLING RUBBER LINED IRON BODY GATE VALVES

Problem: How to get away from costly, special alloy gate valves in handling corrosive fluids and still have long, trouble-free valve life.

Answer: For pressures up to 150 pounds and temperatures to 180° use Darling iron body gate valves with the permanently bonded hard rubber lining. They're giving outstanding service in job after job. Moreover, they have the Darling *fully revolving double disc parallel seat feature* that multiplies disc and seat life and assures tight closure longer . . . much longer!

Write for complete information on these exceptional rubber lined valves . . . or for data on other Darling gate valves including the range of alloys, types and constructions for ordinary or special services.

DARLING VALVE & MANUFACTURING CO.
Williamsport 8, Pa.
Manufactured in Canada by
Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ont.



LARGEST FEED PUMP

Continued from page 177

eliminates any need for additional jackets and their piping connections. Piping is required for the injection water and bleedoff, which is collected without loss and returned to system.

There is no external leakage and drain as required with the packed-type stuffing box. Injection and leakage are constant, whether the pump is running or standing still. This arrangement requires a slight additional flow from the condensate pump at all times, but there is no heat loss. Actually, a small amount of heat is recovered by the injection water as it enters the stuffing box in the area surrounding the breakdown-bushing section. Here it acts as a water jacket and will extract some heat as it progresses. This, at least partially, makes up for the power required to raise the pressure of the water initially in the condensate pump.

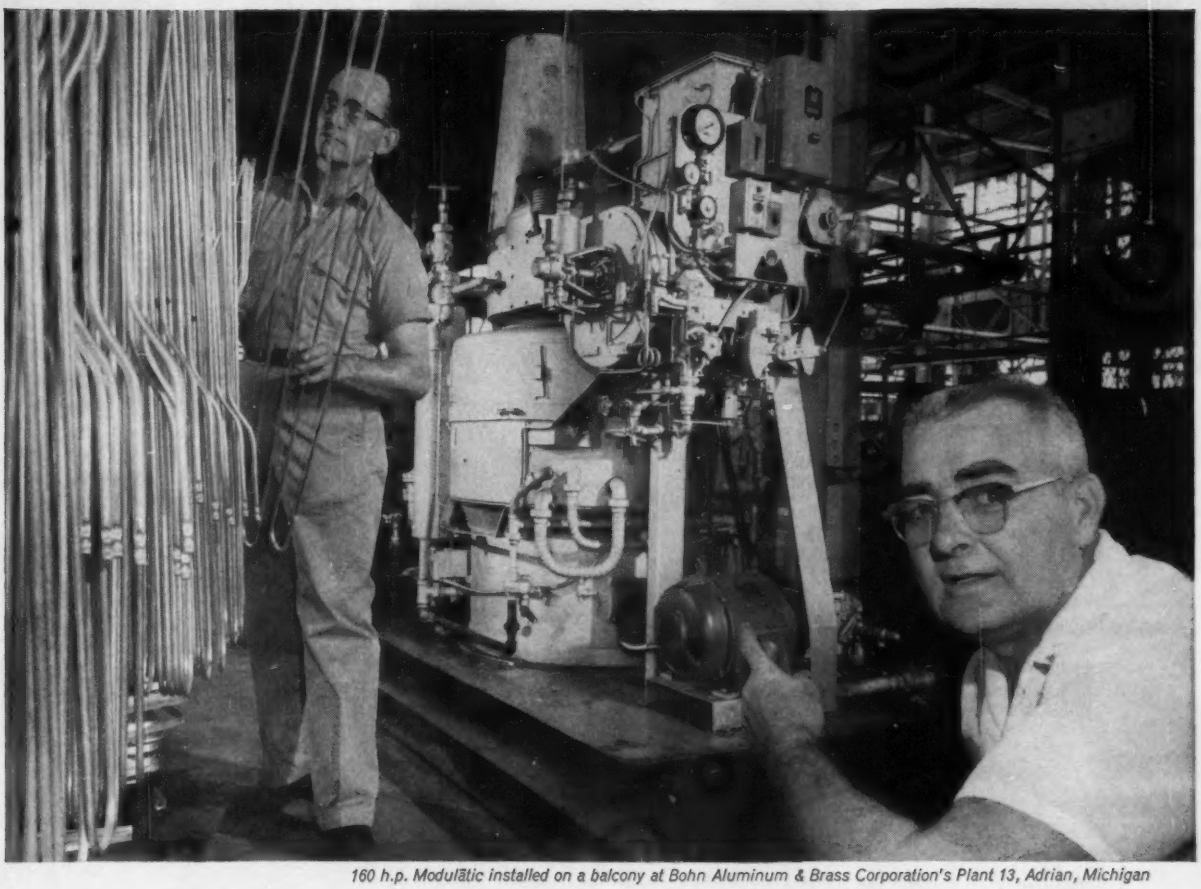
The third type of stuffing-box arrangement proposed was one incorporating mechanical seals. This is believed to be the ultimate answer to practically all stuffing-box problems as it represents the absolute minimum in losses. There is no measurable loss of feedwater and an absolute minimum of heat loss when a mechanical seal is used in the stuffing box. All other arrangements sacrifice either life of the parts, losses of heat and pressure or a combination of these factors.

The manufacturer of this pump has had extensive experience with mechanical seals in a large number of installations on boiler-feed service. Some have been in operation for several years.

With a mechanical seal no heat is generated except between the seal faces; this requires cold injection at this point to prevent overheating and subsequent cracking.

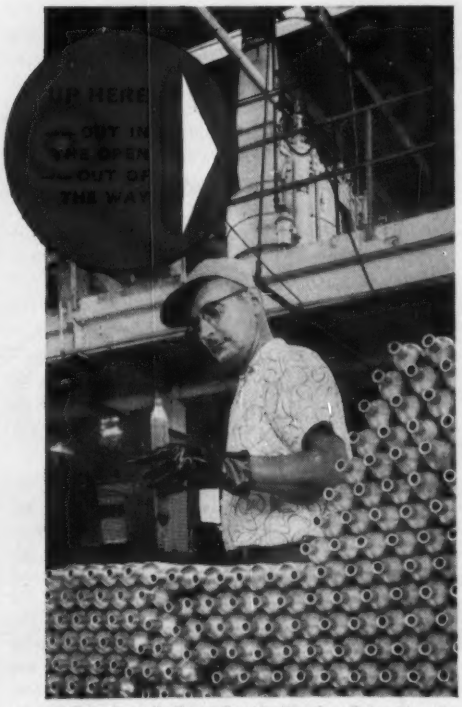
Normally this is provided in one of two ways: (1) If condensate is available above suction pressure it can be injected at the seal faces and a slight amount will be forced inward to the pump. This prevents hot water from inside the pump contacting the seal faces and over-heating them. (2) If the condensate is not available above suction pressure, a small pump is incorporated in the seal design. It circulates the liquid from the stuffing box through a small integral heat exchanger and reinjects cooled water at the seal faces. The only losses are from the heat exchange through the exchanger, which cools water in the stuffing box.

A throttle bushing is normally placed between the seal chamber and pump chamber proper to more or less isolate the liquid in the stuffing box, to reduce the cooling problem and maintain cool



160 h.p. Modulātic installed on a balcony at Bohn Aluminum & Brass Corporation's Plant 13, Adrian, Michigan

MODULĀTIC steam generators solve space problems!



In Canada, write Vapor Car Heating Co. of Canada Ltd., 65 Dalhousie St., Montreal 3, Que.

Front row, balcony, center! It's the "best seat in the house" for this Modulātic steam generator. *Best* . . . because it conserves critical manufacturing area—because, here, it pipes-in with Bohn's other Modulātic—because these two efficient "go anywhere" units make production-steam right where it's used.

How about you! If you need steam for heating, power, or processing, get complete information on the self-contained, push-button Modulātic. It's the world's most compact power-package—takes no more room than a desk and chair.

You have the choice of oil, gas, or combination burner—of eight sizes to 160 h.p.—of pressure from 2 to 285 p.s.i. (or much more, if needed). Over 13,000 already in use.

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Please send me free 12-page Modulātic Booklet No. 586.

Name_____ Title_____

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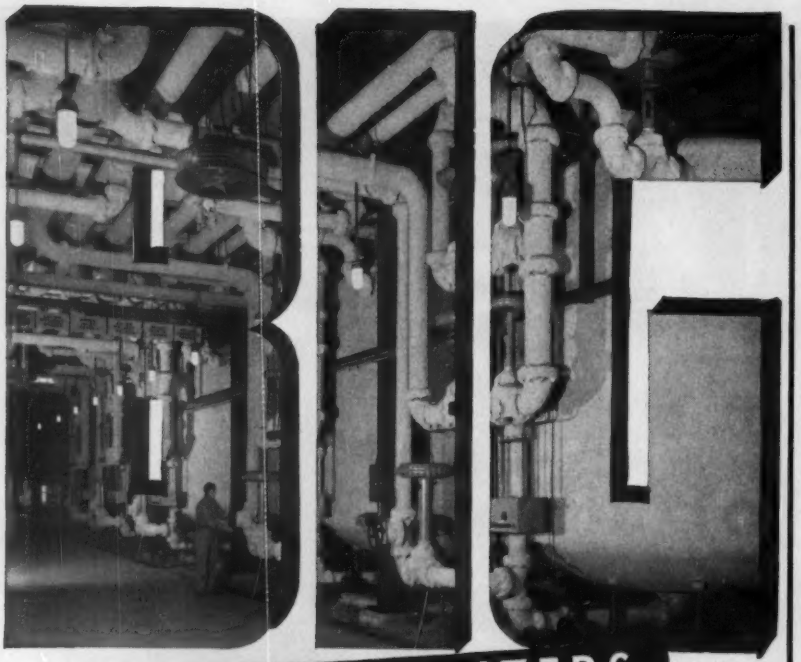

BIG

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USE

Nalcite® (DOWEX*) ION EXCHANGE RESINS

THIS demineralizer, one of the world's largest, provides 100% makeup for 1250 psi boilers generating 1,200,000 pounds of steam per hour. Using Nalco ion exchange resins, Nalcite HCR® and Nalcite SAR, silica is successfully removed from the feedwater — as illustrated by the fact that after 75 to 100 concentrations, silica content of the boiler water is still *less than 5 ppm!*

In demineralizers large or small, Nalcite ion exchange resins give top performance. They are chemically and physically stable for long life at top efficiency. *Two* Nalcite anion exchangers . . . your choice of SAR or SBR . . . are available to meet the conditions of your water supply. Either, used with Nalcite HCR, offers top quality demineralized makeup for high pressure steam generators.

*Reg. Trademark of The Dow Chemical Company.

DATA ON SILICA REMOVAL

A new edition of Nalco Bulletin 57 gives technical data on Nalcite SAR and Nalcite SBR anion exchangers . . . includes complete up-to-the-minute information on silica removal. Write for your copy today.

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PRODUCTS • *When you use Nalcite resins, you take advantage of Nalco's long and broad experience in water and process technology.*

LARGEST FEED PUMP

Continued from page 178

water in the seal chamber itself.

While use of a mechanical seal was an interesting possibility, it was felt that for the intended service a more time-proven arrangement should be used. Therefore, the final decision was for a cold-condensate injection-type stuffing box. The utility engineers insisted that the shaft sleeve and stuffing-box arrangement be planned so a mechanical seal could be installed at a later date with no additional changes. The two stuffing-box arrangements are interchangeable.

Piping. In addition to simple construction and functioning, it was most desirable to have the unit of plain line and uncluttered appearance to blend with the lines of the turbine-generator set. This meant the elimination of all possible piping.

Since the boiler-feed pump is to be mounted on the turbine floor and driven by an extension from the main generator there would obviously be no overhead piping connections. The pump itself is designed with the suction and discharge connections arranged vertically down and connected to the system beneath the floor level. Only the necessary lubricating piping, reservoir, oil cooler and water-injection piping remained to be located.

The utility engineers decided to use a central lubricating system which eliminated the need for these items. This allowed a simple arrangement, and it was only necessary to bring in feed and drain lines to the bearing housings, again coming up from below. Injection and drain lines for the stuffing box were also brought up from below, leaving an absolute minimum of piping visible on the operating floor. Then, to further improve overall appearance, the bearing housing was redesigned for cleaner lines.

The physical size of the unit is of interest. Although it is dwarfed by the size of the turbine and generator, it is still a large piece of equipment as pumps go. The cover for the pump will weigh approximately 6 tons and the studs which hold the cover to the barrel will weigh approximately 150 lb each.

Air conditioning division of Union Asbestos & Rubber Co has been transferred to National-U.S. Radiator Co. The announcement of the transfer was accompanied by a statement that described the move as a further step in broadening National-U.S. Radiator's activities in the fields of heating and summer cooling. It was further stated that the majority of personnel would be transferred without any change in duties.

for cooling tower application...

There's MORE protection against humidity in Allis-Chalmers MOTORS

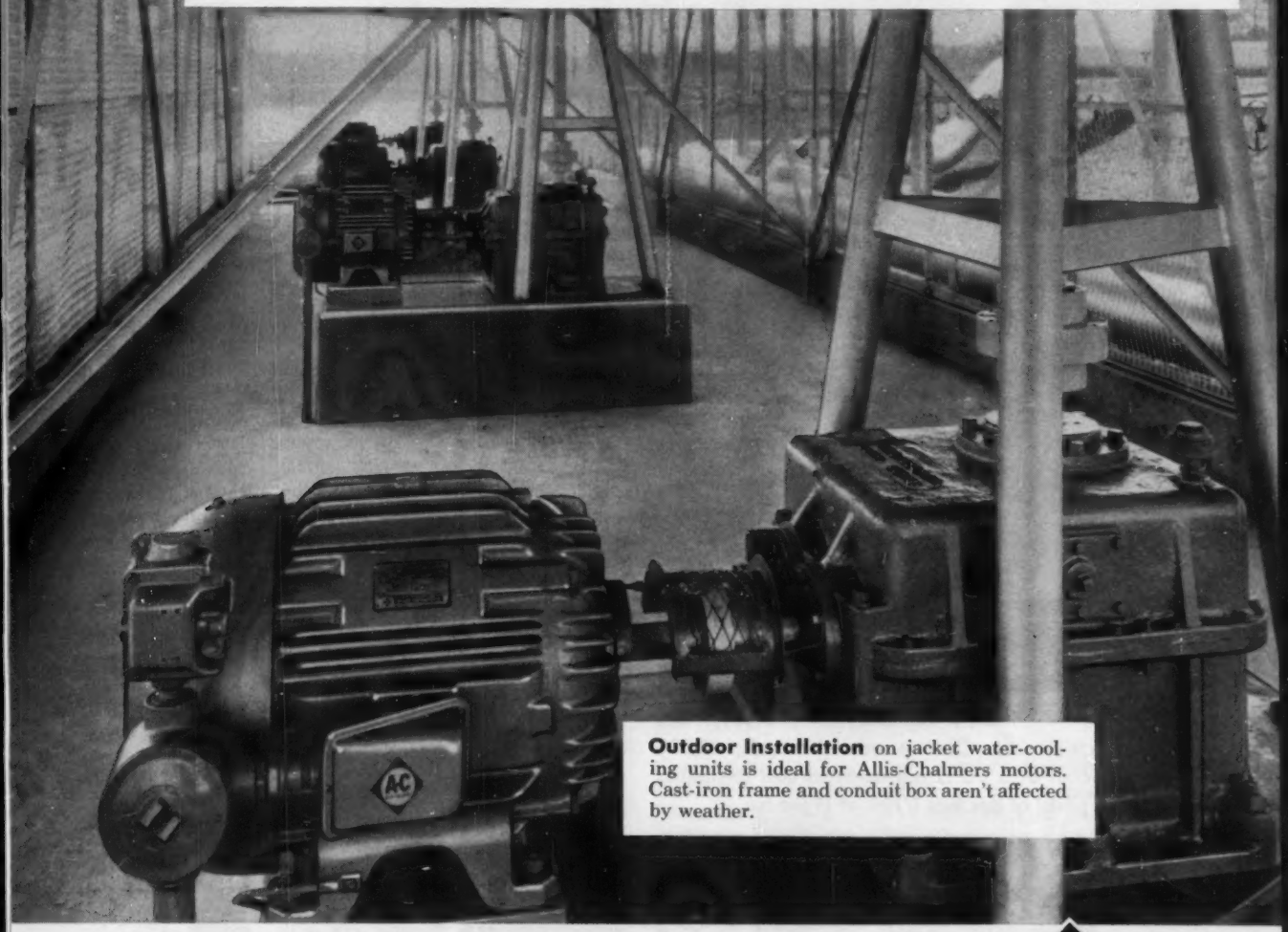
The ultimate in protection against high humidity — major cause of cooling tower motor failure — is provided tower builders and users in Allis-Chalmers TEFC motors. Here's why:

1. **Moisture drainage** — Drain plug can be removed to eliminate condensed moisture in the motor. (Particularly helpful in intermittent operations where condensation is more likely.)

2. **Extra-insulated stator** — Several applications of special insulating varnish plus repeated baking keep humidity out . . . give the long electrical life you need.

3. **Weather-protected bearings** — Rotating seal, turning in close running clearances, guards against entry of water.

Find out more about the "MORE" in Allis-Chalmers motors by contacting your nearby A-C sales office or distributor, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wis.

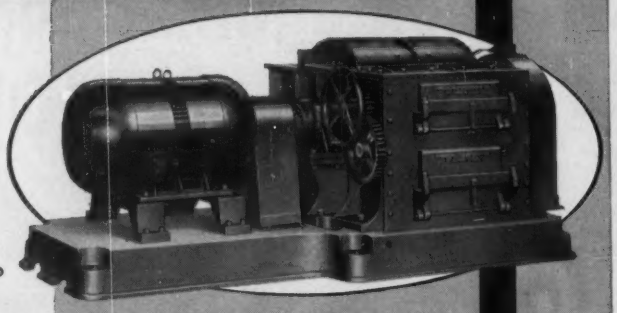


Outdoor Installation on jacket water-cooling units is ideal for Allis-Chalmers motors. Cast-iron frame and conduit box aren't affected by weather.

ALLIS-CHALMERS

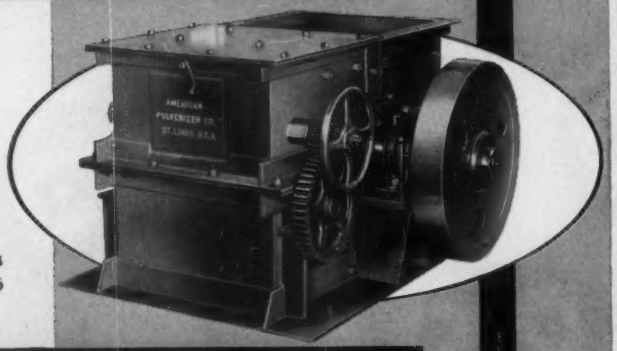
A-5183

When You Figure . . .



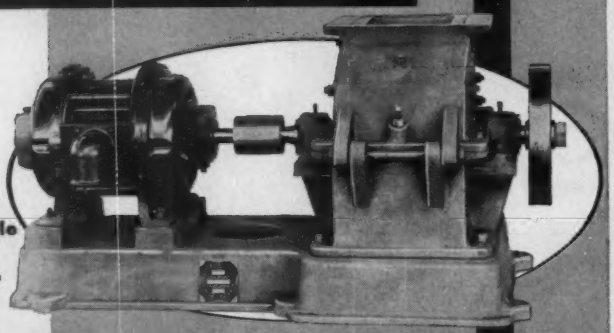
AC Series
capacities to
800 TPH

Reduction
Cost Per Ton . . .



WC Series
capacities to
90 TPH

the Best Answers*. . .



Coal Sample
Crushers
capacities to
2000 Lbs.
Per Hr.

Come from American
Ring Coal Crushers

*In a recent independent survey, it was found that American Crushers reduced over 61,000,000 tons of coal at a parts replacement cost (including standby parts) of *less than 1/10th of 1¢ per ton.*

THERE CAN BE NO BETTER PROOF OF AMERICAN QUALITY!

American
PULVERIZER COMPANY

WRITE for Literature on These Crushers

1349 MACKLIND AVE. • ST. LOUIS 10, MO.

TOP DIESEL PLANTS

Continued from page 115

was up to 31,571,000 gross kwhr, and total production expense was trimmed to a slim 4.597 mills per net kwhr.

Wheatland also has been successful in keeping labor costs low for its four-engine plant. Average 1955 cost for plant labor was just 0.549 mill per net kwhr. Still another notable factor was the low maintenance cost for the four identical diesels. All maintenance costs for the entire plant amounted to just $8,767.93 for the year 1955, an average of 62.6 cents per horsepower for the 14,000-hp plant.

The story of Lea County Electric Cooperative is spectacular. Born formally in 1946, it actually began operation three years later. A quick succession of oil strikes, and by 1953, Lovington was a city of 7500 and still growing fast, with Lea County REA as the sole source of electric power. The oil companies also wanted power to drive well pumps. Meanwhile, the farmers were drilling hundreds of wells for irrigation, equipping each with a motor-driven pump.

In just 34 months, the plant installed seven diesel engines with a combined capacity of 18,800 hp. By 1955, the plant reached a production of 41,640,900 kwhr. Though preoccupied with the problem of meeting tomorrow's demand, the co-op constantly improved efficiency and reduced operating costs. End result was the 1955 average production expense of 4.314 mills per net kwhr, lowest figure in the nation.

SPRINKLER SYSTEMS

Continued from page 119

Central-station supervisory service must be notified before operating any valve or otherwise disturbing the sprinkler system.

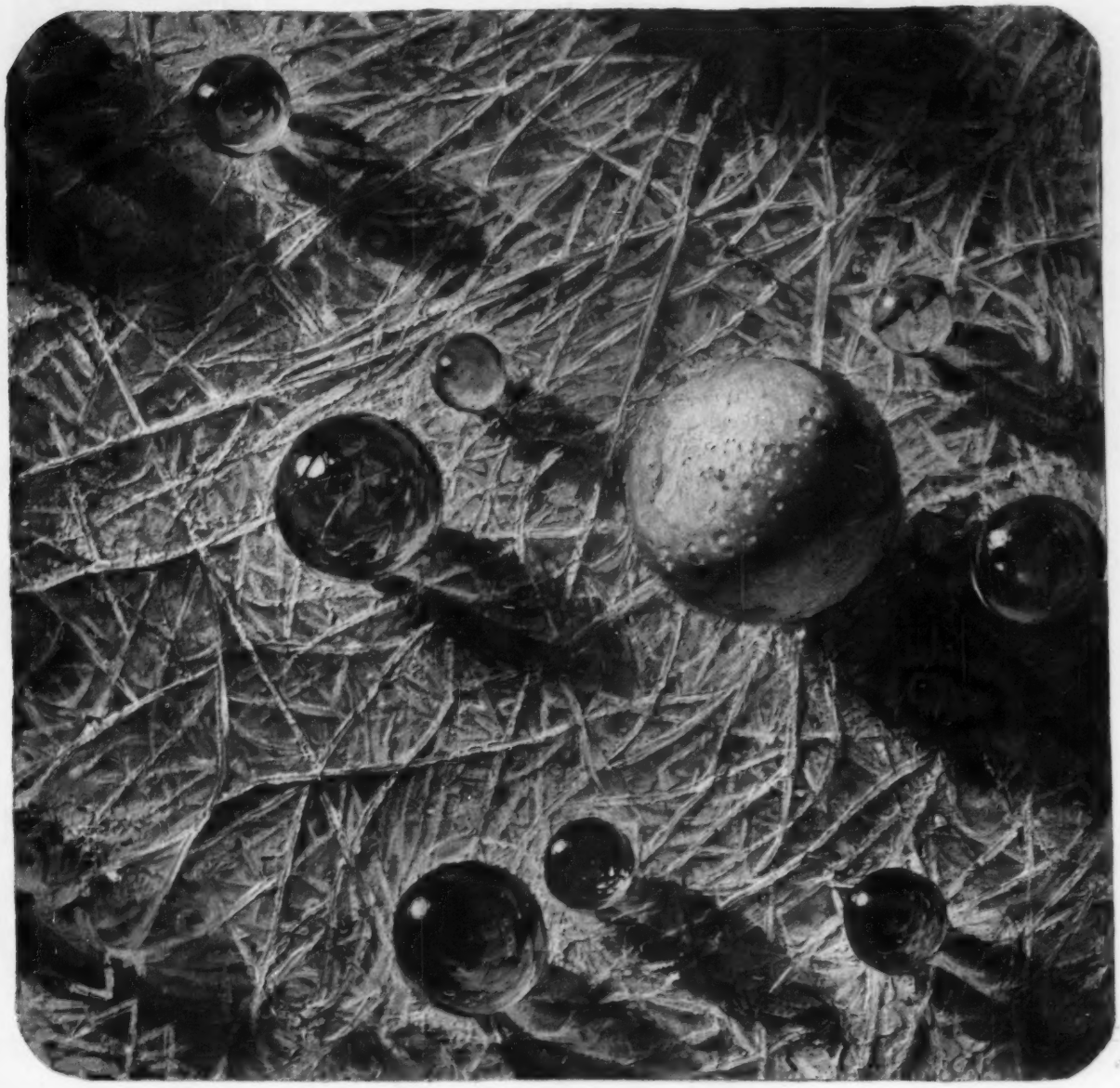
Gravity tanks. Inspect to be sure water level is right. Keep heating devices in order and maintain proper temperature during freezing weather. Keep tank roof tight and hatches shut. See that frost-proof casing of the riser is in good repair.

Keep tank and steelwork properly painted. Carefully inspect piping, valves, heating system, mercury gage, expansion joints, etc. Check through bolts and hidden surfaces of built-up columns for corrosion or weakening.

Always notify insurers in advance if tank is to be out of service. See that no debris falls into tank or riser during repair work. Flush discharge pipes thoroughly after refilling tank.

Pressure tanks. Inspect regularly, checking water level, air pressure, heat-

(*Continued on page* 186)



Beads by the cubic foot

Sitting here for their portrait are beads representative of several AMBERLITE® ion exchange resins. They and the paper on which they are posed have been magnified 24 times—to the detriment of the paper, perhaps, but not to the uniformity of the beads.

Actually, Rohm & Haas Company produces over 20 ion exchange resins, a variety large enough to serve such diverse uses as water conditioning, metals recovery, pharmaceutical production, sugar refining, chemical processing, and decontamination of radioactive wastes. Some AMBERLITE ion exchange resins even act as medicinals.

Gem-like in appearance, the AMBERLITE resins are nonetheless rugged and durable, serve efficiently for many years. They are manufactured in bulk and are sold by the cubic foot.

Can these resins help you? Why not discuss your processes or products with our technical staff? Meanwhile, for a better understanding of ion exchange, write for "Ion Exchange with the AMBERLITE Resins." There's no charge.

ROHM & HAAS COMPANY

THE RESINOUS PRODUCTS DIVISION, PHILADELPHIA 5, PENNSYLVANIA

use steam efficiently, economically—choose the trap with . . .

big capacity

. . . for faster discharge

All a steam trap does is discharge condensate and air from steam lines and equipment—no mystery about it. The bigger its capacity, the faster it can get rid of condensate. But its importance shouldn't be overlooked. On its effectiveness can rest your economical use of steam . . . the efficiency of your process operations.

You get this high capacity in Nicholson steam traps through effective use of a large orifice. And you get much more—simplicity of design and quality through and through.

- **One moving part**
- **Positive shutoff—no steam waste**
- **Powerful, intermittent valve action**
- **Each unit service tested**

Specify Nicholson, and be sure.

Write for new
Bulletin 10-55

NICHOLSON

W. H. NICHOLSON and Company

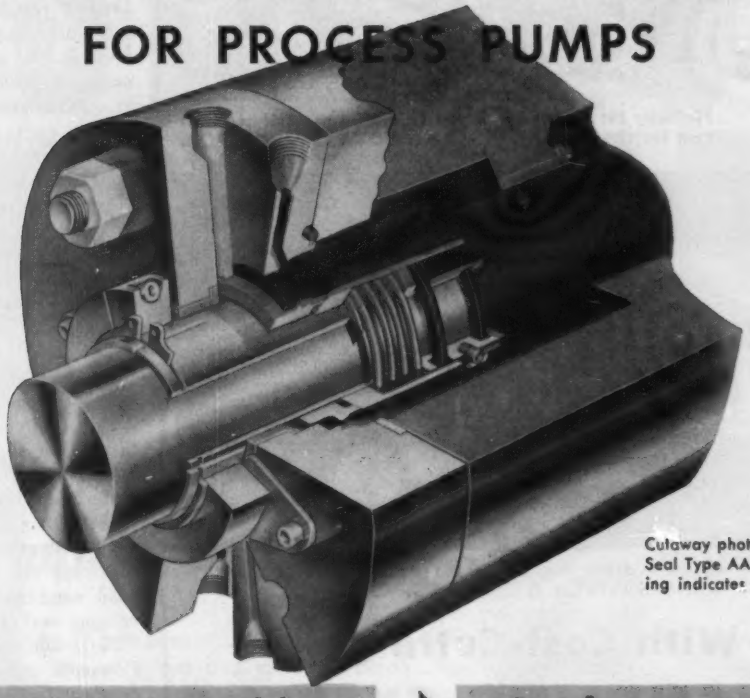
TRAPS • VALVES • FLOATS • METAL PARTITIONS
LAUNDRY, DRY CLEANING AND PRESSING MACHINERY

14 OREGON STREET, WILKES-BARRE, PA. • SALES AND ENGINEERING OFFICES IN 98 PRINCIPAL CITIES

NEW from GARLOCK...

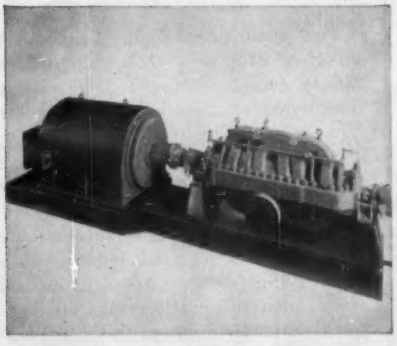
MECHANIPAK* SEALS

FOR PROCESS PUMPS



Cutaway photo of Garlock Unitary Seal Type AA518-23. Yellow shading indicates liquid being sealed.

- One Piece Assembly
- Quick, easy installation
- Pre-set at factory
- Maintenance-free life



Typical boiler feed pump for which Garlock Unitary Seals are designed.

SAVE installation time, eliminate maintenance costs with Garlock's new Unitary Mechanipak Seals for process pumps!

The entire unit, including sleeve and gland, is furnished completely assembled. The seal is pre-set at the factory—no on-the-job adjustments are needed. The *external* lock and drive is readily accessible—eliminates set-screw drive.

Get all the facts today! Phone your Garlock representative or write for new Folder AD-151.

The Garlock Packing Company, Palmyra, New York

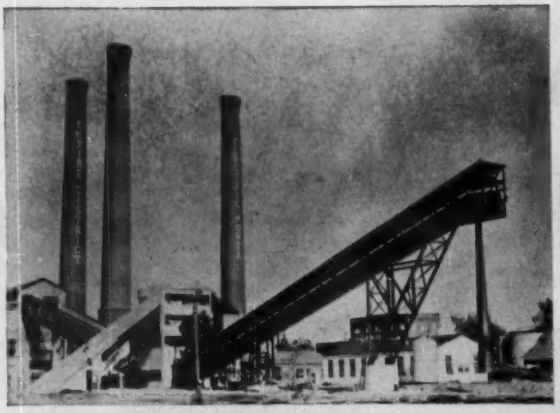
Sales Offices and Warehouses: Baltimore, Birmingham, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Denver, Detroit, Houston, Los Angeles, New Orleans, New York City, Palmyra (N. Y.), Philadelphia, Pittsburgh, Portland (Oregon), Salt Lake City, San Francisco, St. Louis, Seattle, Spokane, Tulsa.

In Canada: The Garlock Packing Company of Canada Ltd., Toronto, Ont.

GARLOCK

*Registered Trademark

EARN EXTRA PROFITS IN SAVINGS



McNally Pittsburg developed this 250 ton per hour system for the EMPIRE DISTRICT POWER & LIGHT CO.

McNally Pittsburg assisted in developing this 300 ton per hour system for the KANSAS POWER & LIGHT CO.

—With Cost-Cutting

COAL-HANDLING SYSTEMS

Engineered for Your Plant

Are you paying "extra fare" luxury rates for that last ride your coal must take from the truck, car, or barge, to your bunkers?

Why pay more? Why risk breakdowns, when you can *save* extra "profits" and be sure of year-round efficiency.

McNALLY PITTSBURG Systems automatically handle more coal per dollar—minimum maintenance costs.

The men who know coal from the ground up will be glad to study your coal-handling problems with you. Mail coupon.

McNALLY PITTSBURG

"The Men Who Know Coal From The Ground-Up"

McNally Pittsburg Mfg. Corp., Dept. PO, Pittsburg, Kansas
Gentlemen: Send more information on your Coal-Handling Systems.

Name_____ Title_____

Company_____

City and State_____

SPRINKLER SYSTEMS

Continued from page 182

ing system. Keep painted, the same as gravity tanks. Consult the safety codes of your locality for testing and maintenance procedures. Pressure tanks are considered unfired pressure containers.

Fire pumps. Start the pump once each week and operate until water discharges freely from the relief valve. Inspect regularly, checking pressure, lube oil supply, relief valve, water level in the priming tank. Keep the pump room clean, accessible and warm enough to prevent freezing.

Test each pump to capacity with hose streams at least once a year during the warm weather. Use fire pumps only for fire protection; not for plant service.

Check suction pipes, intakes, foot valves and screens frequently. Make sure they are free from ice or other obstructions. Mud, gravel, leaves and other foreign material entering the suction pipe may damage the pump or obstruct the sprinkler-system piping.

For centrifugal pumps, also check the electric power supply and, if pump is engine driven, check the storage batteries, lubrication system, oil and fuel supplies.

Fire department connections. Be sure caps are in place, threads are in good condition, ball drip or drain is in order and check valve is not leaking.

For information in this article, POWER *is indebted to National Board of Fire Underwriters, American District Telegraph Company, Grinnell Company, Inc.*

AIR CONDITIONING

Continued from page 91

system connects through reducing valve to the various steam-process equipment.

Four flexible hose connections branch off from each control box to deliver air to ceiling diffusers. Air volume distributed through control boxes are damper controlled.

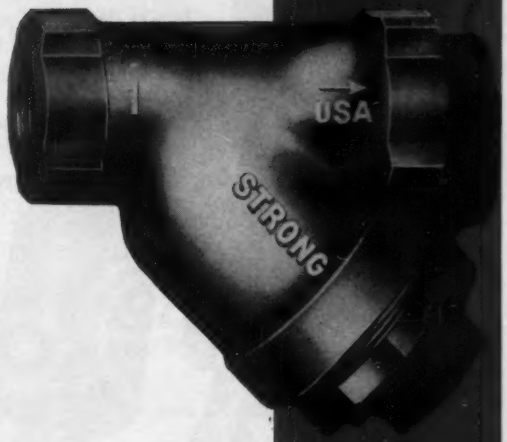
Socony Mobil needs little overhead space for fitting in the high-pressure ductwork used in their loop system. Duct's 12-in. diameter is substantially less than that required for a comparable low-pressure system. Acoustical ceiling material neatly masks all ductwork. Even air diffusers look like nothing more than ordinary ceiling panels.

A common and costly problem for the building owner, that of modifying the original air-conditioning installation when a tenant wants to rearrange office space, has been eliminated. Ceiling diffuser panels can easily be lifted out

POSITIVE PROTECTION FOR YOUR SYSTEMS!

STRONG STRAINERS

trap dirt, scale, sludge, sediment



Stainless screens . . . perforated or woven wire . . . rust and corrosion proof . . . standard interchangeable sizes . . . tap for pipe plug or valve

Rugged bodies . . . extra tough semi-steel, bronze, cast steel, block steel or chrome moly construction withstands rough use . . . threaded, flanged or socket weld connections

Attractive range of sizes . . . from ¼" to 6" strainers with .027", 1/16", ⅛" perforations; 60 or 100 mesh screens

Dirt-free steam, water, air, oil or gas lines are assured when Strong Strainers are on the job. They come in "Y" or angle types. Strong Strainers are available for every need, **built right, priced right for your requirement.**

For complete specifications and prices see your **Strong Distributor** or write . . .

50 years in steam specialties

STRONG, CARLISLE & HAMMOND COMPANY
1392 WEST 3rd STREET • CLEVELAND 13, OHIO

air traps • steam traps • reducing valves • vacuum or pumping traps
continuous blowdown valves • separators • engine stops • F and T traps

ROTOJET®

Cleans TUBES and PIPES

ANY SIZE

from ½" to 12" I.D.

STRAIGHT or CURVED

Roto engineers are constantly designing new equipment to meet new conditions and applications for its tube cleaners. If you have a pipe or tube cleaning problem, we will be pleased to place our long specialized experience at your disposal. Write, wire or

Phone HUmboldt 3-0570

Illustrated are a few of the many types and sizes of Rotojet Tube Cleaners driven by air, steam or water. We analyze each application before recommending equipment that best meets the requirement.

ELLIOTT COMPANY - ROTO DIVISION

Tube Cleaner Specialists Since 1910

153 Sussex Avenue, Newark, N. J.

AIR CONDITIONING

Continued from page 186

and moved as far as the length of their flexible hose connections.

Acoustical material in each control box attenuates noise of fans or other equipment. Because system is high velocity, noise might otherwise be carried through main ducts.

Another common problem—supplying air to off-hours tenants—has been smartly solved. Since most tenants needing service at other than normal office hours are on the lower floors, refrigeration for air conditioning is supplied by the 500-ton machine in the sub-basement. Bulk of the plant is shut down. Result: Economical plant operation.

Building maintenance men have their jobs greatly simplified by electrostatic air filters used with air-handling equipment. These units remove practically all airborne dirt, dust, soot, smoke.

My biggest boner

A plant should post on a bulletin board every boner that's been pulled in that plant. Then employees can profit from each other's mistakes, instead of repeating them.

In our vocational-school boiler room we use advance students to help out. Jobs include firing boilers and all other duties that operating engineers must eventually perform in a plant.

One morning I asked a student to light off a gas-fired boiler. Thirty minutes later I checked on his progress because we weren't getting any heat. Natural-gas valves were partly open—so far so good. But the air registers were closed tight. I immediately closed the gas valves. Then I looked into the furnace through the observation port, which has a pyrex-glass window to keep air out. There was only a trickle of flame where a little air was leaking around the register.

Instead of letting the gas in the furnace burn out slowly for lack of air, I opened the register suddenly so the draft could clear the gas from the furnace. WHAM—the explosion door blew clear out of the brickwork and across the room. Fire brick was also badly damaged—had to be renewed. As luck would have it, no one was hurt—the luck of the ignorant. Hope my boner keeps a lot of you operators from having your heads blown off.

E SCRAGGINS *Chilocco, Okla.*

AN "O" RING
for every purpose
EFFECTIVE SEALING

DISTRICT OFFICES

BALTIMORE, MD.
BOSTON, MASS.
BUFFALO, N. Y.
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CHICAGO, ILL.
CLEVELAND, OHIO
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DETROIT, MICH.
HOUSTON, TEX.
INDIANAPOLIS, IND.
LOS ANGELES, CAL.
MILWAUKEE, WIS.
MONTREAL, CANADA
NEW ORLEANS, LA.
NEW YORK, N. Y.
PHILADELPHIA, PA.
PITTSBURGH, PA.
SAN FRANCISCO, CAL.
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ST. LOUIS, MO.
TOLEDO, OHIO
WILMINGTON, CAL.

Ankorite "O" rings provide effective sealing through a range of pressures, temperatures and movements. When properly applied they exert low running friction on moving parts.

Ankorite "O" rings are accurately molded to close tolerances from compounds of natural rubber, Ankoprene, Buna N, Thiokol, Silicone, etc.

They offer many advantages:

1. Production cost is reduced by elimination of complicated assemblies.
2. Special assembly tools are not necessary.
3. Economical to use since only one "O" ring is required on piston or rod.
4. Long life, fluid-tight packing is assured with correct design and machining of grooves and mating parts.

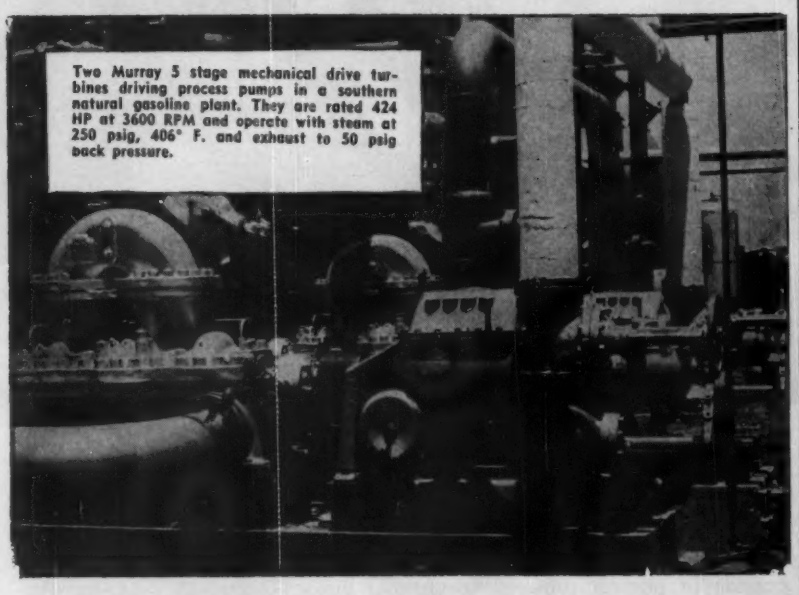
"O" ring gaskets used as static seals have been known to withstand pressures as high as 15,000 p.s.i. In most other applications "O" rings are suitable to pressures up to 2,000 p.s.i. where radial clearances do not exceed .003".

THE ANCHOR PACKING COMPANY

GENERAL OFFICES: PHILADELPHIA, PA.
FACTORIES: MANHEIM, PA. ELKHART, IND. MONTREAL, CAN.

FIBROUS AND METALLIC PACKINGS FOR EVERY INDUSTRIAL PURPOSE

Murray Turbines



Two Murray 5 stage mechanical drive turbines driving process pumps in a southern natural gasoline plant. They are rated 424 HP at 3600 RPM and operate with steam at 250 psig, 406° F. and exhaust to 50 psig back pressure.

● MURRAY TURBINES for mechanical drive can be furnished for various combinations of the following conditions:

Horsepowers up to 15,000
Speeds up to 11,000 RPM
Steam up to 600 psig, 750° F.
Back pressures up to 300 psig., or condensing

● MURRAY mechanical drive turbines are built in various combinations as follows:

Single stage turbines
Multi stage turbines
Mechanical fly ball type governors
Oil pump direct acting oil governors
Oil pump oil relay governors
Fly ball oil relay governors
Single governor valve with or without hand valves
Multiple automatic governor controlled inlet valves

MURRAY IRON WORKS COMPANY
BURLINGTON, IOWA

Builders of Steam Power Equipment for Three Quarters of a Century

SYSTEM GROUNDS

Continued from page 121

done with a tester designed for the purpose, although it can be performed with an ammeter and voltmeter. There are several complications, however, which the ground tester automatically takes care of. Test current should be ac, preferably not of power frequency, if ground currents (which are often considerable) are not to interfere with meter readings. Dc is unsatisfactory because it polarizes electrodes, giving false resistance values for ground connections.

Connections for fall-of-potential test are shown in diagram p 21 with current electrode at *C* and potential electrode at *P*. Under ordinary conditions, for rod or pipe grounds down to 8 ft in the earth, distance *A* should equal *B*, and should be about 50 ft. For large-area grounds, such as tanks, *A* should be five or more times the length of longest diagonal across area covered by ground, with *B* equal to 100 ft or more. Using ammeter and voltmeter, ground resistance is found by dividing voltage by current. Ground-resistance tester reads directly in ohms, contains all elements including ac source that is driven by handcrank.

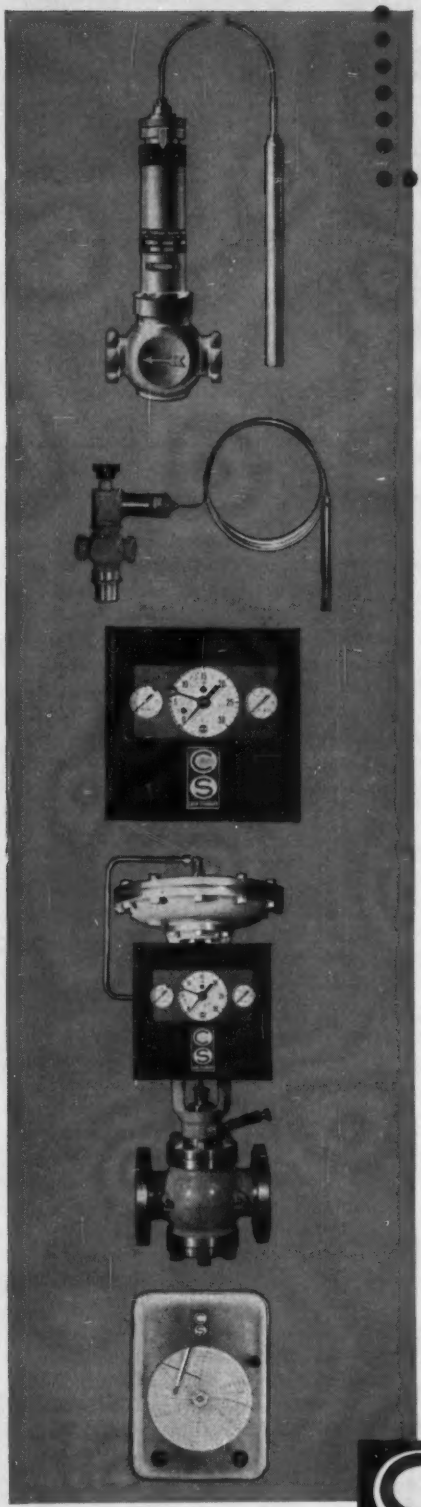
Ground resistance. If ground resistance is too high something must be done about it. This usually means additional ground connections using pipes or rods. In some cases resistance of earth itself is so high that chemical treatment is necessary. Effect of chemical treatment is not usually permanent and must be repeated when resistance climbs too high. Graphs on p 121 show results of tests made by Copperweld Company's engineers on deep rods, rods in multiple and on chemical treatment of soil in ground-connection area.

TURBID WATER

Continued from page 111

Dimensions of each of these units are 47 ft wide, 96 ft long, 17 ft deep. Four chemical feeders, to treat the water with lime, alum, clay and, when required, sulfuric acid, were also installed. This installed equipment has a rated capacity of 15 million Imperial gallons daily (18 million U.S. gallons) which is more than required at present, but takes into consideration future demands.

The purification plant has been in operation since March 1954. According to Mr D O Davis, vice-president, engineering, Dofasco is now using industrially-clean water furnished by the system at a cost of only $0.04 per 1000 Imperial gallons, in place of city-treated water at a cost of $0.15 per 1000



For Accurate, Reliable Temperature Control

STACON V SERIES
Self Operating Temperature Regulators—

Feature a liquid filled thermal system for high operating power and uniform throttling action and has built-in over-load protection. Available in 50°F. and 100°F. ranges from 25° to 325°F. Direct and reverse acting units ¼" to 1½" with screwed ends, and 2" to 4" with flanged ends. Bulletin No. 500. (Cash Standard Stacon Corp.)

STACON TYPE VS
Temperature Safety Regulators—

Used in the supply steam or gas line and will protect a process by snapping shut when the process temperature goes above a desired temperature level. Easily adjustable and remains closed until manually reset. Available in sizes from ½" to 1½" with screwed ends. (Cash Standard Stacon Corp.)

CASH STANDARD TYPE 51
Indicating Controllers—

An air operated, mercury actuated proportional temperature controller. Temperature ranges from —40°F. to 1000°F. Calibrated set point adjustment, unit construction, air relay with sapphire orifice and push button cleaner, feedback type proportional control with 1-100% band and differential gap. Also available with 1-150% proportional band combined with automatic reset action. Bulletin No. 978. (A. W. Cash Co.)

CASH STANDARD TYPE 30
Diaphragm Control Valve (With Type 51 Mounted)

A rugged, dependable control valve—available in sizes ½" to 12" with various styles of inner valves—reverse or direct acting. Accurate control is assured when the Type 30 is used with 51 or 57 controllers, valve mounted as illustrated, or where the controller is installed remotely. Bulletin No. 980. (A. W. Cash Co.)

CASH STANDARD TYPE 57
Recording Controllers—

An air operated temperature controller with mercury, vapor, gas or organic liquid actuation. Temperature ranges from —350°F. to 1200°F. Available in 9" and 12" case size, spring or electric driven chart drive, on-off control or 1-100% proportional control.

All units have push button nozzle cleaner; proportional controllers also have sapphire jewelled relay orifice with push button cleaner. Bulletin No. 979. (A. W. Cash Co.)

WHAT'S *YOUR* TEMPERATURE CONTROL PROBLEM?

Cash Standard and Stacon have the answer or will find one.

Contact the Cash Standard temperature and pressure control specialist in your area, or write Dept. E

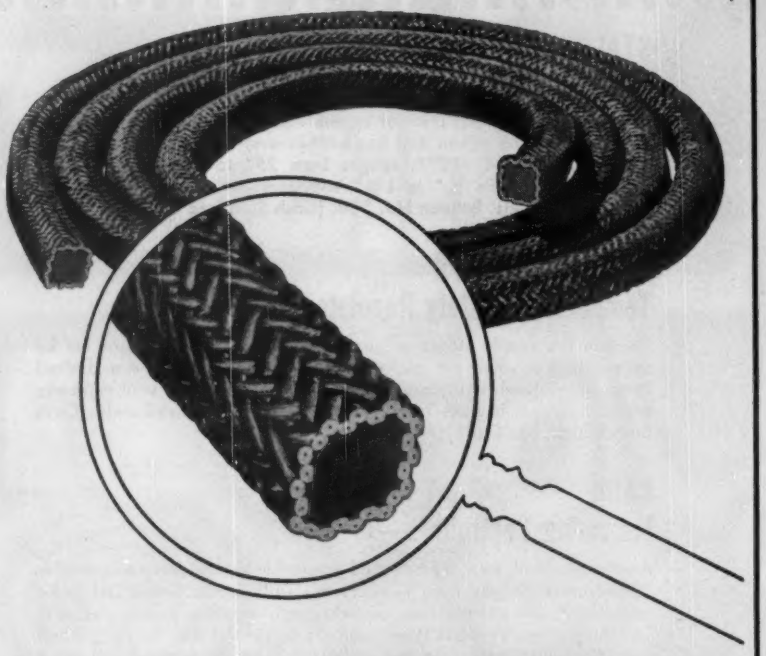
CASH C S **STANDARD**

A. W. Cash Co. and Its Subsidiary, Cash Standard Stacon Corp.
P. O. Box 551, Decatur, Ill.

PRESSURE, HYDRAULIC, TEMPERATURE, PROCESS AND COMBUSTION CONTROLS

RUGGED...

for superheated pressures



BELMONT 4040

Here is a steam valve packing that performs well on superheated steam temperatures as high as 800° F.

Inconel wire-inserted asbestos is braided over a non-metallic plastic core to combine strength for high pressures with compressibility for good sealing characteristics. Supplied square in cross section, in sizes 3/16" and up.

Ask your U.S. Gasket-Belmont Packing Distributor or write for Catalog No. 56.

Belmont Packing & Rubber Co.
Butler & Sepviva Streets
Philadelphia 37, Pennsylvania

U.S. GASKET • BELMONT PACKING

TURBID WATER

Continued from page 190

gallons—cutting costs by about 75%. He fully expects the plant to pay for itself in from four to five years.

Comparative costs are hard to assess at this point because of the company's vastly increased use of water since 1952. Now, with increased production and processing, overall use of water has increased from 9 to 11 million Imperial gallons daily. However, demand on the city supply has been cut from 4.5 to 3 million Imperial gallons in the same period. Thus, the direct reduction in city-water charges is about $100,000 annually, including the difference in cost if city water had been purchased to take care of the additional demands.

It has been estimated that the total cost of the water-treating project was $575,000, of which $100,000 represents engineering, chemical feeders, purification and control equipment. At present, the purification system treats an average of 8 million gallons of Hamilton Bay water daily. Average total cost of operating the equipment is $323 per day, or $0.04 per 1000 Imperial gallons (1200 U.S. gallons). A realistic figure of the yearly maintenance cost is not available since the plant has been operating for such a short period.

The four chemical feeders distribute almost three tons of chemicals per day and average dosages represent 1500 lb of lime, 2700 lb of clay, and 1400 lb of alum and occasionally some sulfuric acid. With these chemicals added to the turbid supply, the raw water is thoroughly mixed by baffles before entering the precipitators, at a valve-controlled rate, for coagulation and filtration. This controlled flow maintains water at the proper level.

Height of the sludge blanket in the units is automatically controlled by photoelectric cells operated by a beam of light shining through a continuous thin stream of water drawn from a preselected level in the upflow sludge filter compartment.

This treatment reduces turbidity of the rather murky and highly-turbid raw water to an average of 5 ppm, making it entirely suitable for industrial utilization. It also brings the pH of the raw water from an acid condition of 5.0 to 6.0 to a slightly alkaline condition of 7.5

Plans for construction of a multimillion-dollar distribution transformer plant in Athens, Ga., were announced in Pittsburgh, Pa., by Westinghouse Electric Corp. Gordon C Hurlburt, manager of the distribution transformer department at Sharon, Pa., has been named manager of the new plant.

For more economical operation

Modernize electric distribution systems with SORGEL air-cooled transformers or substations

INCREASE FEEDER CAPACITY AND EFFICIENCY BY TRANSMITTING ELECTRIC POWER AT HIGHER VOLTAGES TO LOAD CENTERS

The most practical type transformers to step down voltages at load centers are SORGEL air-cooled dry-type transformers. They can be installed in almost any convenient place inside of buildings, without fire-proof vaults or other enclosures. SORGEL transformers are of the highest quality, and require little or no maintenance. No liquid to check nor replenish; small and compact; easy and convenient to install; economical operation.

Increased efficiency—Because SORGEL transformers can be installed close to load centers, the result is shorter feeders, better voltage regulation, more efficient distribution, and lower wiring cost.

Quiet operation—The sound level of SORGEL transformers is well below the established standards. This outstanding feature is appreciated where low sound levels are an important factor. For that reason they are particularly adaptable for indoor installations close to load centers.

Easy installation—Attached wall brackets, with slots for bolts, or floor mounting base. No separate mounting brackets nor junction boxes to make or buy.

A perfect partner for substations—SORGEL transformers can also be incorporated in substations, complete with primary and secondary switchgear. They are procurable with any make of switchgear, and from any substation manufacturer.

Available in the following ratings:

¼ Kva to 2500 Kva, single phase.

1 Kva to 3000 kva, 3-phase, 2-phase and phase changing.

All standard voltages, such as 120, 208, 240, 480, 600, 2400, 4160, 4800, 7200, 13,200, up to 15,000 volts, and any intermediate or special lower voltages.

Tested and approved by Underwriters' Laboratories under the Re-examination Service

Stock carried by jobbers in the following cities:

New York, N. Y.
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Philadelphia, Pa.
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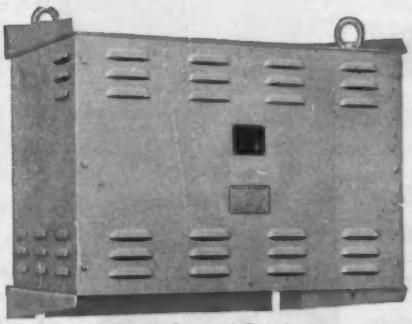
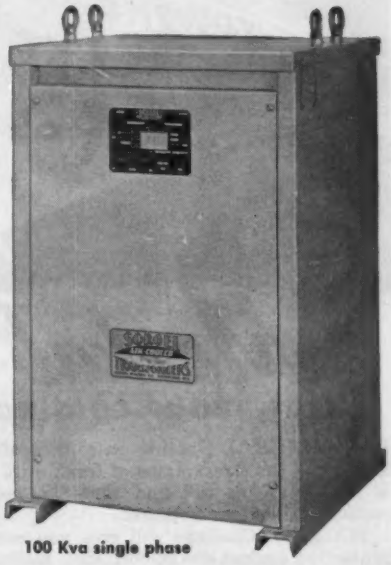
Consult the classified section of your phone directory or write to factory

Also special transformers and saturable reactors

¼ Kva single phase 480/240 to 240/120 volts



15 to 50 Kva 3-phase. Wall mounting type



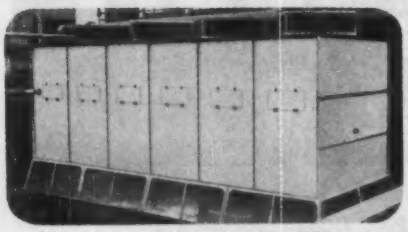
100 Kva single phase

SORGEL ELECTRIC CO., 844 West National Avenue, Milwaukee 4, Wis.

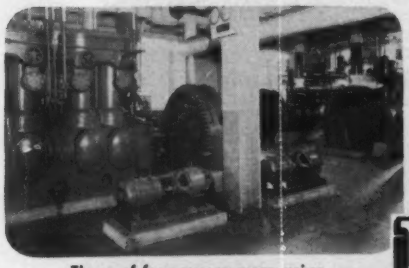
Sales Engineers in Principal Cities

FRICK Refrigeration

Installed in Huge Brewery in Montreal



Evaporative condenser handling 330 tons of refrigeration



Three of four compressors using 1800 horsepower

Dow Brewery, established in 1790, now has a yearly output of over 1½ million barrels. Frick refrigerating equipment, including compressors, condensers, brine coolers, and carbon-dioxide liquefying system, was selected for an important expansion modernization program. Installation by J. H. Lock & Sons, Ltd., Frick Distributors in Toronto.

For the utmost dependability—whether on air conditioning, ice making, quick freezing, or other refrigerating work—specify Frick equipment.

FRICK CO.
WAYNESBORO PENNA.

Markal
HEAT-PROOF COATINGS

Brush MARKAL Coating on a piece of metal and apply the direct flame of torch until metal is red hot. You will find that the *protective coating has not been impaired.*

MARKAL Coatings will give you complete protection against steam, corrosion, scaling, oxidation at extreme heat—temperatures up to 2100°F. Easy to apply!

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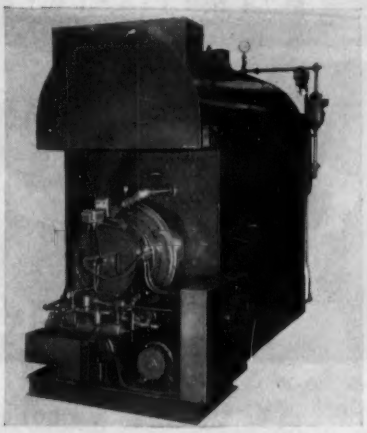
Write for complete technical information and free sample . . . important that you state conditions.

The Mark of Quality Protection—MARKAL!

More EQUIPMENT NEWS

Begins on page 158



Packaged fire-tube boilers

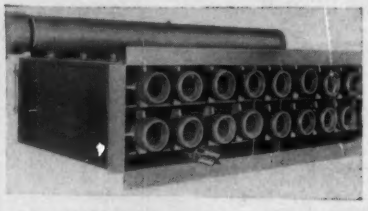
1050 • Fire-tube boiler-burner units, with installation and operating advantages of the Scotch marine type *Steam-Pak* packaged steam generators, are offered in a full line of ratings. Package design eliminates the need for stack, pitting and brickwork. Water cooling virtually eliminates replacement and maintenance costs of the carborundum combustion chamber and increases boiler capacity, according to manufacturer.

Four-pass arrangement of boiler tubes assures maximum heating efficiency. Unit can be furnished to supply either low pressure steam (15 psi) or hot water (30 psi). Firing may be by No. 3, 5 or 6 oil and/or natural or manufactured gas. Boiler can also be converted to coal firing by the addition of a grate.

New line of fire-tube boiler-burner assemblies is offered in equivalent net steam ratings of 3000 to 35,000 sq ft and in equivalent net hot-water ratings of 4800 to 56,000 sq ft. Each boiler-burner unit is fire tested and adjusted for high and low fire prior to shipment from the factory.

York-Shipley, Inc, York, Pa.

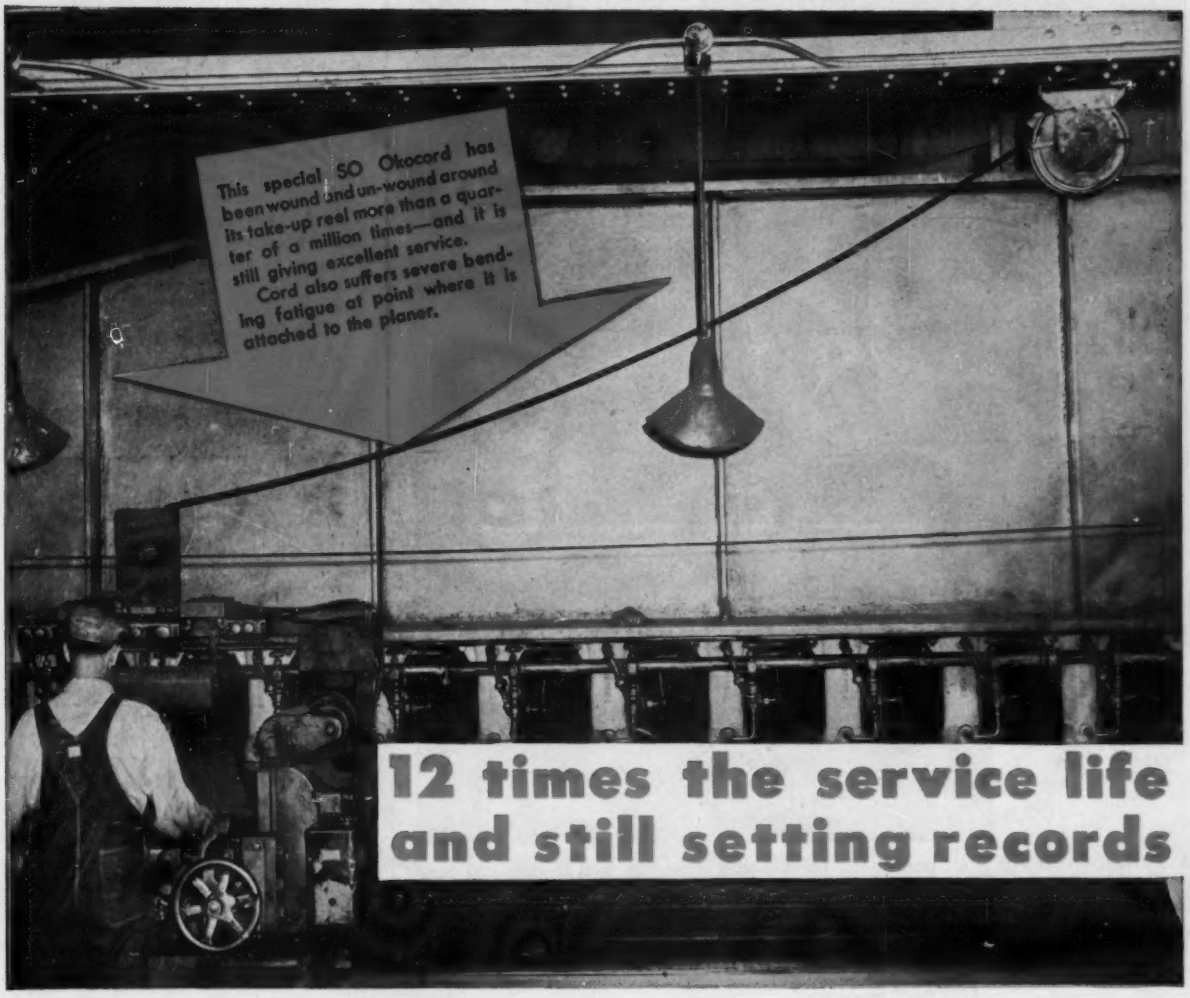
For more details on these items, use post cards p 165. Identify your request with item number.



Inshot gas burner

1011 • Atmospheric type inshot gas burners are designed to burn natural, manufactured or mixed gases in commercial and industrial applications.

Capacities on the various sizes range from 99 cfh on 1000-Btu gas to 7512 cfh. Special features include tandem-jet nozzles which create a mixture of gas and primary air for proper combustion and the flame retention ring which stabilizes flame


This special SO Okocord has been wound and un-wound around its take-up reel more than a quarter of a million times—and it is still giving excellent service.
Cord also suffers severe bending fatigue at point where it is attached to the planer.

12 times the service life and still setting records

Until recently, a large steel fabricator was plagued with costly failures on control cable to the carriage of a 45′ planer. Ordinary Type SO cable was unable to withstand the great bending fatigue of constant winding and unwinding on a small take-up reel as the carriage moved back and forth an average of 45 times an hour for 90 hours per week. Cables had to be replaced about every six weeks.

Okonite engineers solved this problem with a special SO Okocord* construction. Combined with Okocord's normal high standards of quality, this construction completely eliminated the fabricator's problem. *The special SO Okocord has now been in service since April 1953—and is still giving excellent service.*

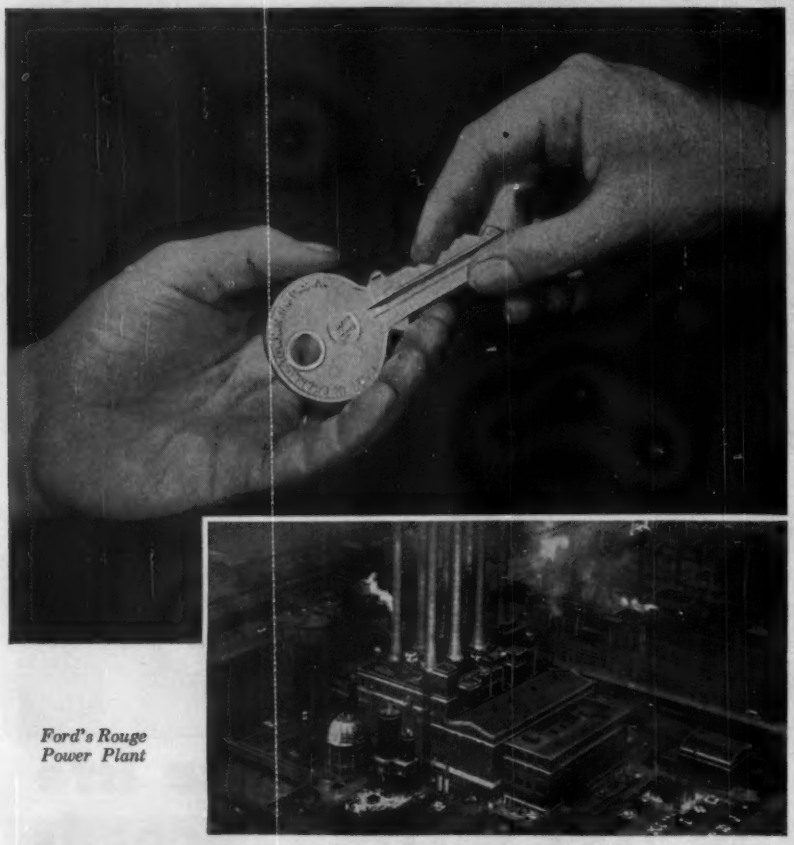
This successful installation is just one example of Okonite's ability to design Okocord constructions for difficult installations. Whenever you have problems involving a portable power supply, Okonite can help you eliminate costly down-time and power failures. Why not contact your Okonite representative today? Or write directly to The Okonite Company, Passaic, New Jersey.

***This product formerly carried the trade name Hazacord**

2646-A

***where there's electrical power . . . there's* OKONITE CABLE**

WHY A TURN-KEY PROJECT IS BEST FOR YOU



Ford's Rouge Power Plant

A Turn-Key project is a "packaged" service that combines engineering and construction in a single contract . . . and that may include other services such as preliminary investigations, studies and site selection, procurement of materials and equipment, initial operation of the finished plant.

Advantages to you:

LESS COST: Who is better qualified to construct a project than the firm that designs it? In a Turn-Key project one organization performs both engineering and construction services; details are handled quickly, efficiently—therefore more economically.

LESS TIME: Excavation can be made and foundations started several months prior to the release of the Engineer's completed design drawings and specifications. Construction follows blue prints—promptly. This scheduling of design and procurement to meet construction requirements permits the project to advance in an unbroken sequence—setting the stage for a faster delivery of the completed plant.

MORE SERVICE: One contract gives you *complete* service—no question about responsibility. Thus you have better control and more closely integrated planning.

We offer you engineering and construction services separately but suggest you consider combining them into a Turn-Key project that will save you both time and money. Write today for this free booklet describing the advantages in detail.

POWER • AVIATION • PETROLEUM • TEXTILES • INDUSTRY

The Kuljian Corporation

engineers • constructors

1200 North Broad Street • Philadelphia 21, Penna.

More EQUIPMENT NEWS

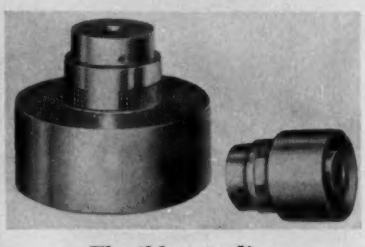
Begins on page 158

at burner tip, assuring a smooth, steady flame during each "on" cycle.

It is said that burners are virtually noiseless in "on" and "off" cycles. Manufacturer claims that design eliminates popping, backfiring, burning in jets and other objectionable characteristics.

Electronic safety control equipment is standard. Low fire start is provided on all sizes. Modulation, while standard on larger sizes, may be specified for smaller sizes if desired. Request details from manufacturer.

Ray Oil Burner Co, 1301 San Jose Ave, San Francisco, Calif.



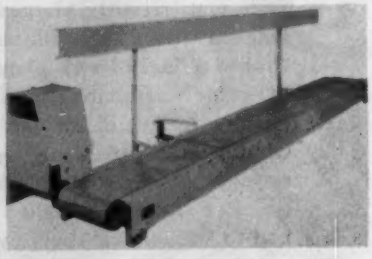
Flexible coupling

1028 • Coupling incorporating brake drum flange on outer diameter is said to be particularly useful where shaft length or distance between two units is at a premium.

Coupling is available in eight standard sizes, with hp ratings from 2 to 40 at 1750 rpm. Maximum bores of hub body range from 1 to 2½ in. Drum body bores are made to shaft motor size specifications. Distance between shafts runs from ½ to 1⅝ in. Cushions are one-piece spider type.

Lovejoy Flexible Coupling Co, 4801 W Lake St, Chicago 44, Ill.

For more details on these items, use post cards p 165. Identify your request with item number.



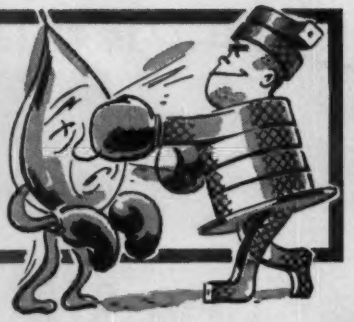
Telescoping bag conveyor

1033 • Flat-belt bag conveyor features variable belt speeds and an adjustable frame. Frame is telescopic in design to provide a choice of conveying lengths. It is constructed in two parts; the rear half can be telescoped over the front half for a minimum conveying length of 7 ft. Full length, with both sections fully extended, is 12 ft.

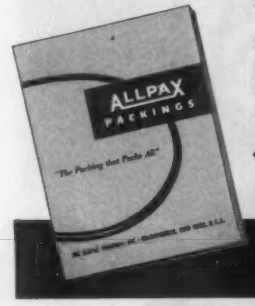
Motor equipment, including motor platform, is available as an optional component. A ¾-hp non-gearhead motor is available for belt speeds from 25 to 42 fpm. A 1-hp motor can be supplied for

SETTING
NEW STANDARDS
OF PERFORMANCE...
Another
LUNKENHEIMER
FIRST!
THE
LQ600
VALVE
FIG. LQ600-200
200 lb. S.P.—400 lb. W.O.G.
550° F.
FIG. LQ600-150
150 lb. S.P.—300 lb. W.O.G.
¼ to 2 inches
Thousands of these valves have served for as long as five years without replacement, regrinding, maintenance, or leakage—even on the most severe services. Their patented Brinalloy* seats and discs are more resistant to wear and corrosion than 500 Brinell Stainless Steel . . . even outlast case-hardened Stainless Steel exceeding 1000 Brinell. LQ600 Valves practically eliminate maintenance costs!
*Patented Alloy—T. M. Reg.
SEE YOUR LUNKENHEIMER DISTRIBUTOR
or write for literature
THE LUNKENHEIMER CO., CINCINNATI 14, OHIO
LUNKENHEIMER®
THE ONE Great NAME IN VALVES
L-456-28

You can't beat ALLPAX for PETROLEUM SERVICE



Petroleum service separates the men from the boys in the packing field—but you can count on Allpax Packings for this rugged service. The result of extensive laboratory research, these packings are recommended for use against most oils and oil derivatives on centrifugal and rotary pumps, valve stems, swing joints and similar pumping equipment.



Style No. 14—Compounded of long asbestos fibres, fine flakes of graphite, and a special bonding compound containing an oil-resisting lubricant.

Style No. 30—For use against petroleum products at high temperatures and pressures. Very dense, made by braiding jackets of asbestos yarn over a center core of pure asbestos content.

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Here's A Positive Way to test your Bucket type Steam Traps!

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- NO MOVING PARTS
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THE TRANSPARENT TEST PLUG TO CHECK STEAM TRAPS AT-A-GLANCE

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a FILL & EMPTY cycle of condensate occurs each time the trap dumps—and shows up in the Vis-A-Plug sight glass.

If your trap is FAULTY . . .
a STEADY continuous condition shows up in the Vis-A-Plug sight glass.

Manufactured exclusively by
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P.O. BOX 100
KING OF PRUSSIA, PENNA.

WRITE FOR BULLETIN OR CONTACT YOUR LOCAL TRAP REPRESENTATIVE

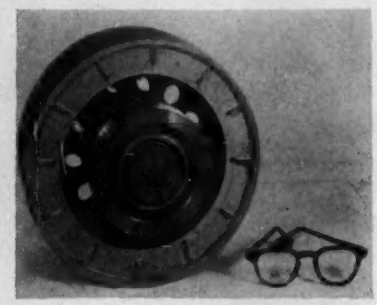
More EQUIPMENT NEWS

Begins on page 158

belt speeds from 40 to 60 fpm. Motors meet Class I Group D or Class II Group G requirements.

Pulleys supplied with conveyor are self-cleaning "cage" type. Conveyor belt is 5-ply neoprene over 10-oz duck. Request information on optional equipment direct from the manufacturer.

Richardson Scale Co, Van Houten Ave, Clifton, N. J.



Magnetic drive

1037 • Unit provides a flexible slip-type drive between motor and its load, in a range from fractional hp to over 50 hp. Drive consists of two component parts—magnetic rotor, which is a cylinder to which are attached Alnico V permanent magnets; and a bi-metallic rotor, which is a copper-faced, mild steel plate or cylinder perforated with steel rivets.

Drive is said to provide high efficiency (95%) at rated hp under full operating loads. No power loss in fluids, particles or mechanical friction, due to seals. No pumps, coolers or exciters to cause additional power drain.

Cylindrical design is adaptable to new, smaller NEMA frame standards. Manufacturer says that exterior temperatures from –60 F to 250 F will not affect performanc of standard drive. Overload protection for the driving motor is a basic built-in feature. Drive can be run in full stall (i.e. 100% slip) indefinitely, according to manufacturer, without harming motor or coupling. Request full details from manufacturer.

Whitney Chain Co, 237 Hamilton St, Hartford 2, Conn.

For more details on these items, use post cards p 165. Identify your request with item number.

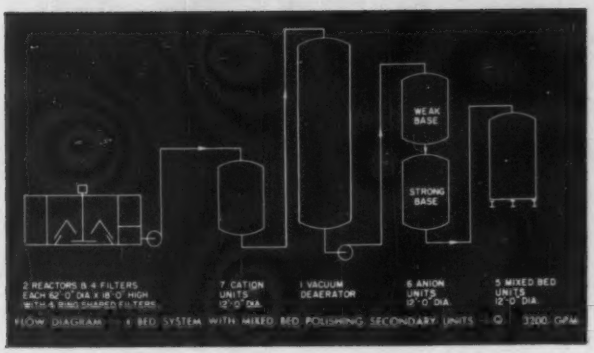
Fire-resistant compound

1026 • Resinous compound will insulate a metal surface against reaching 1000 F for 30 minutes while being subjected to 2000-F flame, according to manufacturer.

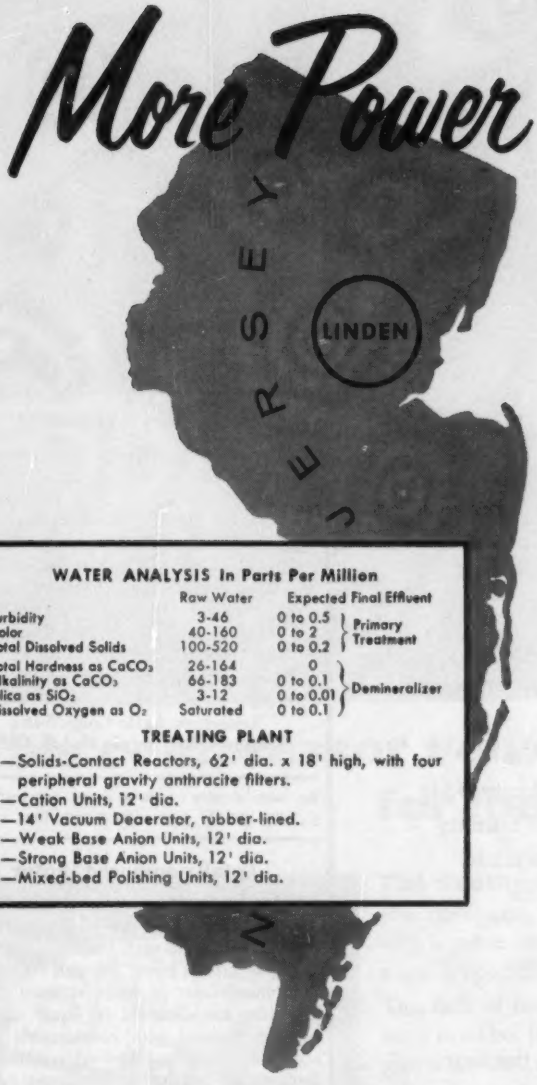
The fire retardant is a heavy-bodied black mastic which can be sprayed or trowelled to a thickness of ¼ to ⅜ in. on metal, wood, fibreboard and other materials. Manufacturer claims that it will not run, drip, drop off, or contribute fuel to the flame. Retardant can be applied wherever high temperatures could conceivably be encountered.

It serves as an interior or exterior coat-

First in water conditioning


WEAK BASE
STRONG BASE
2 REACTORS (8 4 FILTERS EACH 62'-0" DIA X 18'-0" HIGH WITH 4 RING SHAPED FILTERS
7 CATION UNITS 12'-0" DIA
1 VACUUM DEAERATOR
6 ANION UNITS 12'-0" DIA
5 MIXED BED UNITS 12'-0" DIA
FLOW DIAGRAM — 4 BED SYSTEM WITH MIXED BED POLISHING SECONDARY UNITS — Q 3200 GPM

More Power FOR NEW JERSEY



Cochrane Feedwater Treating System will protect high pressure boilers and turbines at Linden Generating Station.

Public Service Electric and Gas Company's new Linden Generating Station will feature the most outstanding Demineralizer Plant ever installed. The system, designed and manufactured by Cochrane, will treat 30 to 100% make-up for boilers with design pressures up to 2700 lbs.

Some of the unique features include complete automatic remote control for both primary treatment and Demineralizer Plant . . . Filter and demineralizer backwash recovery for re-use . . . Re-use of most anion rinse water . . . Low acid consumption . . . Silica reduction in two stages: first, by strong base anion units, then by mixed bed units . . . Low caustic soda requirements . . . Resins cleaned in place . . . Hydraulic emptying of resins. These and many other features assure the ultimate in efficiency for this plant.

Cochrane's years of experience in the design and manufacture of every type of water treating equipment are your assurance of continuing satisfactory performance. Why not consult them today?

WATER ANALYSIS In Parts Per Million

	Raw Water	Expected Final Effluent	
Turbidity	3-46	0 to 0.5	Primary Treatment
Color	40-160	0 to 2	
Total Dissolved Solids	100-520	0 to 0.2	
Total Hardness as $CaCO_3$	26-164	0	Demineralizer
Alkalinity as $CaCO_3$	66-183	0 to 0.1	
Silica as SiO_2	3-12	0 to 0.01	
Dissolved Oxygen as O_2	Saturated	0 to 0.1	

TREATING PLANT

2—Solids-Contact Reactors, 62' dia. x 18' high, with four peripheral gravity anthracite filters.
7—Cation Units, 12' dia.
1—14' Vacuum Deaerator, rubber-lined.
6—Weak Base Anion Units, 12' dia.
6—Strong Base Anion Units, 12' dia.
5—Mixed-bed Polishing Units, 12' dia.

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CORPORATION
3106 N. 17TH STREET, PHILADELPHIA 32, PENNA.
NEW YORK • PHILADELPHIA • CHICAGO
Cochrane Water Conditioning Ltd., Toronto 4; Montreal 1, Canada
Representatives in 30 principal cities in U.S.; Paris, France; La Spezia, Italy; Mexico City, Mexico; Havana, Cuba; Caracas, Venezuela; San Juan, Puerto Rico; Honolulu, Hawaii; Manila, Philippine Islands.
Pottstown Metal Prods. Div.—Custom built carbon steel and alloy products.

COCHRANE CORPORATION WATER CONDITIONING ENGINEERS SINCE 1863 PHILADELPHIA

Demineralizers • Zeolite Softeners • Hot Process Softeners • Hot Lime Zeolite Softeners • Dealkalizers • Reactors • Deaerators • Pressure Filters Continuous Blowoff Systems • Condensate Return Systems • Steam Specialties

A LIGHT THAT NEVER FAILS

Now Possible With Peabody Rifled Tile For Gas Fired Burners

Lost ignition need no longer worry users of gas-fired burners, even under the most adverse firing conditions. The new Peabody tile, specially designed and rifled in direct opposition to rotating air flow, in the rotating fuel and air mixture develops low-velocity eddy currents that give desired ignition. The protected burning eddies act as *a series of continuous and positive pilots* for the main body of the combustible mixture. This new tile permits *minimum load* setting of gas with rapid *maximum* settings of wind-box pressure *without loss of ignition!*

Available on new or old Peabody installations, the new Peabody Rifled Tile offers users unusually high efficiencies, plus unequalled dependability of ignition—under even the most adverse firing conditions. Write today for complete details.

PEABODY ENGINEERING CORPORATION

232 MADISON AVENUE, NEW YORK 16, N. Y.

OFFICES IN PRINCIPAL CITIES

PEABODY LIMITED • LONDON, S.W. 1, ENGLAND

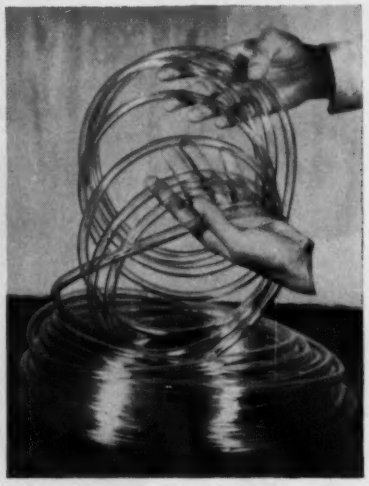
6-132

More EQUIPMENT NEWS

Begins on page 158

ing to insulate, reduce condensation, rustproof and waterproof in the range of –20 F to 250 F. It is said to weather well, withstand acid, alkali fumes and splash, and not to support mildew.

Insul-Mastic Corp of America, 7750 W 61st Place, Summit, Ill.



Flexible vinyl tubing

1022 • Maximum-clarity vinyl tubing for laboratory and plant application will handle a wide variety of chemicals and reagents. According to manufacturer, it is flexible and non-toxic.

Available in both transparent-vinyl and translucent-polyethylene forms, it may be steam sterilized.

Tubing is available in sizes from ⅛ ID x ¼ OD to 1 ID x 1¼ OD, with 11 standard sizes offered. Request additional information from manufacturer.

American Agile Corp, 5461 Dunham Rd, Maple Hghts, Ohio

For more details on these items, use post cards p. 165. Identify your request with item number.

Totally-enclosed motor

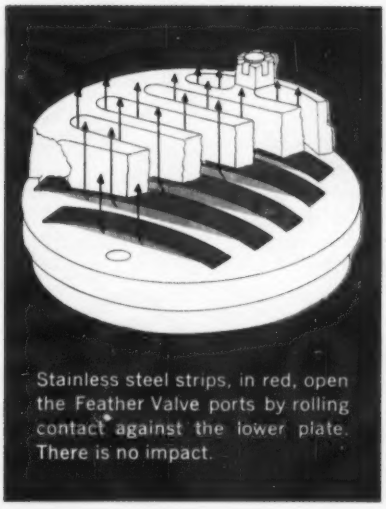
1054 • Unit employs two external cooling fans—one at each end—that draw cool air directly across each bearing, then drive it the length of motor through large cooling tunnels cast in walls of main frame. The fans are designed to direct air onto bearing housing with considerable force, scrubbing away heat and maintaining uniformly cool bearing temperatures. A deflector at end of each air passage directs discharge air away from cool air intake.

Bearings are open type with provision for regreasing and pressure relief without removing any part of the motor should such servicing be desired. A wide range of speeds are available in ratings from 50 to 200 hp, with larger sizes on special order. Additional information is available upon direct request to the manufacturer.

Delco Products Div, General Motors Corp, Dayton 1, Ohio

(*Continued on page* 204)

This compressor valve works with no impact for longer life, best efficiency



Stainless steel strips, in red, open the Feather Valve ports by rolling contact against the lower plate. There is no impact.

The Feather* Valve is the lightest, simplest, quietest compressor valve ever developed. Flexible strips of stainless steel open and close the valve ports with a gentle rolling contact. There is no destructive impact . . . even when the valve is operating as fast as forty times a second.

This lack of impact assures long life and negligible maintenance. The valve itself is all but indestructible. Absence of buffer plates and cushioning devices give it extreme simplicity.

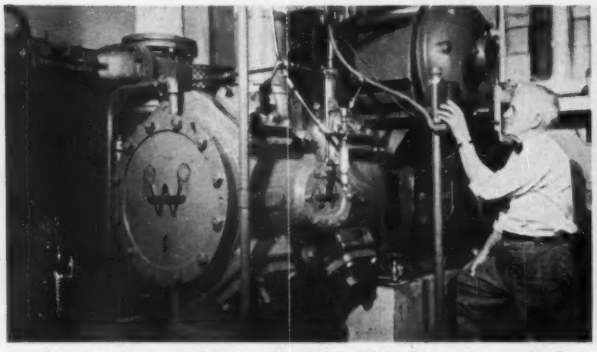
The Feather Valve is quiet and reliable because of its lightness and tight contact seating. Valve action is very sharp. There is virtually no slip or back flow. As a result, you get minimum valve loss and use minimum power.

To get the utmost in performance, be sure you specify Worthington when you buy your next compressor. Worthington Corporation, Harrison, N. J. K.6.2

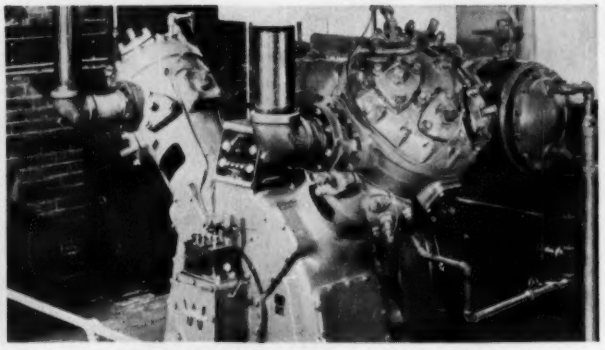
WORTHINGTON

*Reg. U. S. Pat. Off.

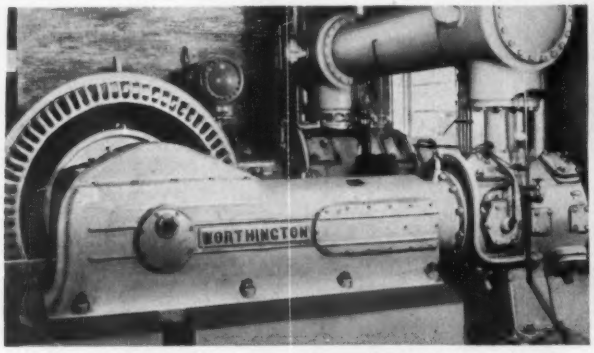
No compromising machine selection with this complete compressor line



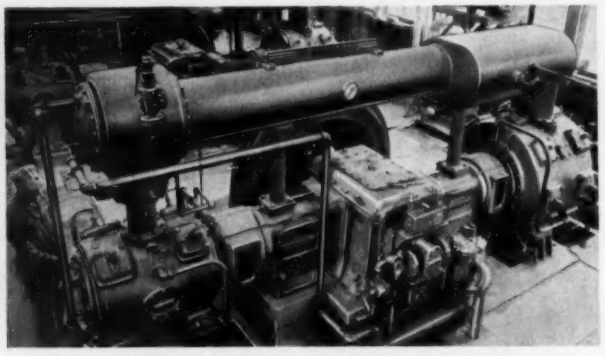
Single-stage compressor, type HB. For economical, continuous supply of air in smaller quantities. Sizes range from 10 to 125 hp. (Bulletin L-640-B1C)



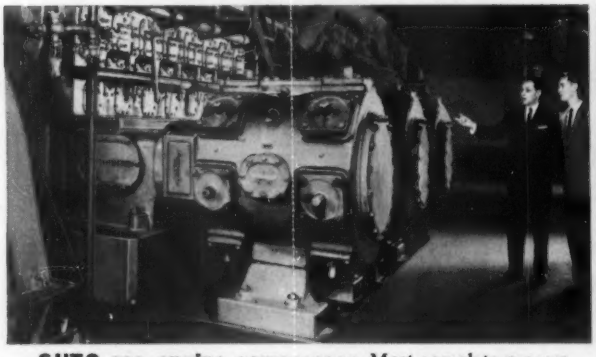
Two-stage angle compressor, type YC. Most compact unit for its capacity. Available up to 250 hp, and in larger sizes in similar type DYC. (Bulletin L-676-B1A)



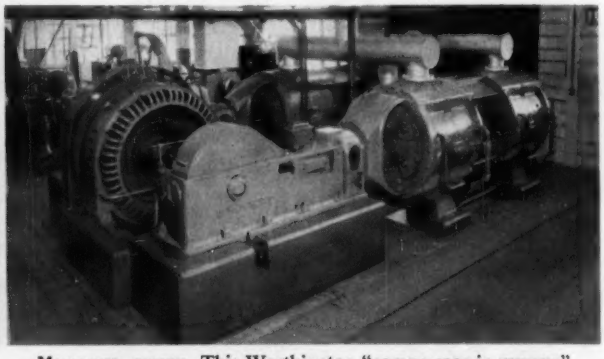
Horizontal duplex compressor, type DC-2. A two-stage compressor designed for heavy-duty service. From 250 to 3,000 hp. (Bulletin L-675-B1B)



Balanced opposed compressor, type BDC. Versatile—ideal for either multiple or single-service applications. Sizes from 300 to 10,000 hp. (Bulletin L-679-B1)



SUTC gas-engine compressor. Most complete process flow flexibility with 2-cycle compactness. Available in ratings from 750 to 2,500 hp. (Bulletin S-550-B23D)

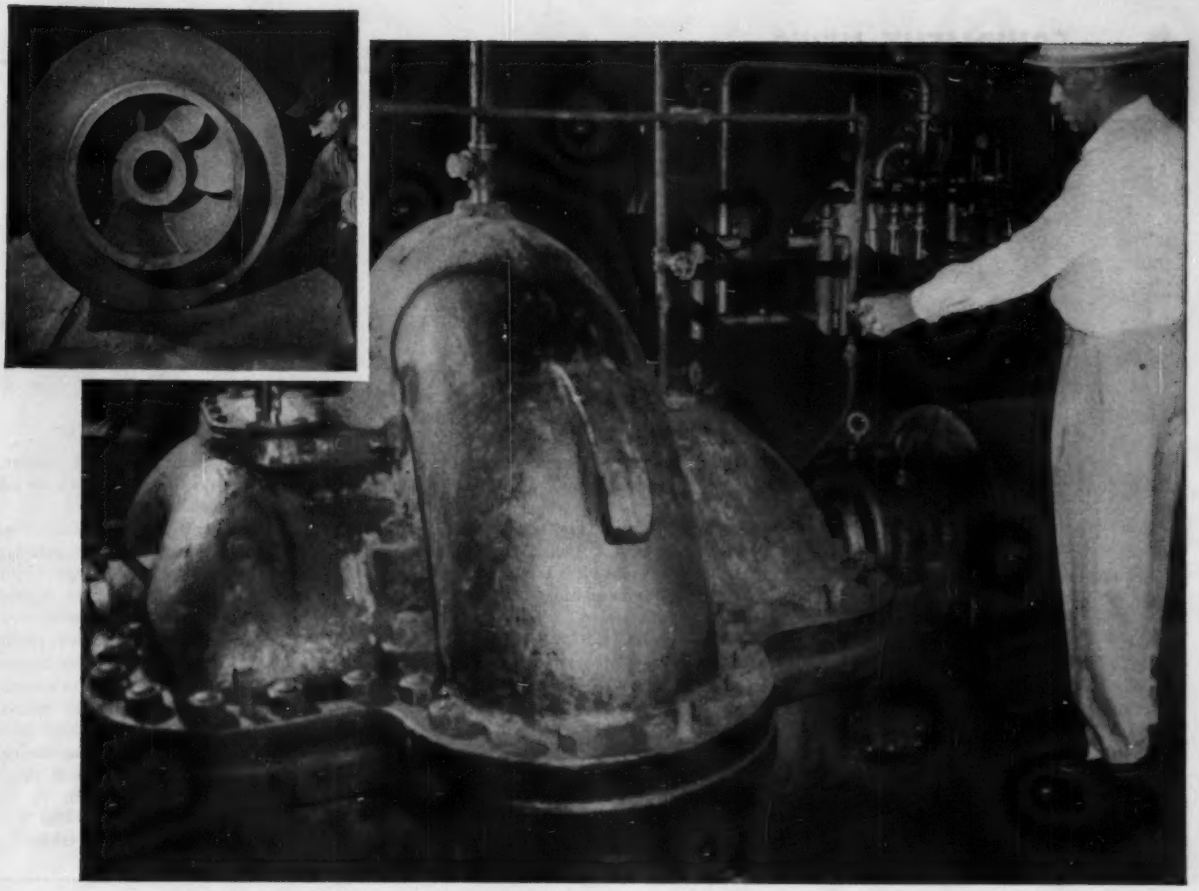


Vacuum pump. This Worthington "compressor in reverse" provides pressures as low as .25 psia. Available in sizes from 10 through 2,500 hp. (Bulletin L-600-B9-4)

A compressor and drive for your every compression job is available in the standard Worthington line. Sizes range up to 10,000 hp, air and gas pressures to 35,000 psi. For more information about any of these Worthington compressors, write to Section K64, Worthington Corporation, Harrison, N. J. In Canada: Worthington (Canada) 1955, Ltd., Toronto, Ont.

K.6.4

WORTHINGTON



No Slow Joe. This power plant pump handles 240,000 gallons of salt water every hour. Its 2,200-pound impeller — cast by the INCO Foundry at Bayonne, N. J. — is shown at upper left. To meet Caloil demands for *utmost* corrosion resistance, it's made of *Monel!*

Pumping salt water at 40,000 gpm

Monel impeller helps coastal power plant end threat of breakdown by corrosion

The California Oil Company has a big industrial power plant at Perth Amboy, New Jersey. Right at hand is all the water they need for their cooling system.

But it's *salt* water. And you know how destructive that can be . . . what corrosion it can cause.

So Caloil had an impeller of Monel* nickel-copper alloy put in. Weighing 2,200 pounds, it was specially cast at INCO's Foundry in Bayonne, New Jersey.

This large Monel casting has excellent resistance to corrosion. And it's *tough*, too! Actually, Monel lends more strength than the impeller *needs* to stand centrifugal stresses and plenty of hardness to resist wear.

Over and over, that's the way it is with Monel. It gives you an *extra* margin of performance. Helps make your equipment last longer. Helps keep your maintenance expense low. And helps make downtime less of a threat!

There are probably *many* ways Monel can save money for you. Find out more about them. Ask for "Engineering Properties of Cast Monel" and "Cast 'S' Monel." Write today!

*Registered Trademark

The International Nickel Company, Inc.
67 Wall Street New York 5, N. Y.

More POWER for you . . . with MONEL — **INCO NICKEL ALLOYS** (TRADE MARK)

More EQUIPMENT NEWS

Heat-resistant paint

1051 • This quick-drying heat-resistant paint is for use on surfaces subjected to temperatures up to 600 F. It air dries to a tough, bright finish in less than two hours. Developers claim it can be used in any quantity without interrupting regular work schedules since it achieves maximum effectiveness without special baking and has no objectionable odor during use.

In addition to extreme temperature variations, the paint is said to resist smoke, moisture, fumes, mild industrial acids and alkalies. It is recommended for protecting steam lines, vats, separators, exhaust manifolds, stacks, tanks, ovens and heat lines.

Speco, Inc, 7308 Associate Ave, Cleveland 9, Ohio

Germanium plating rectifier

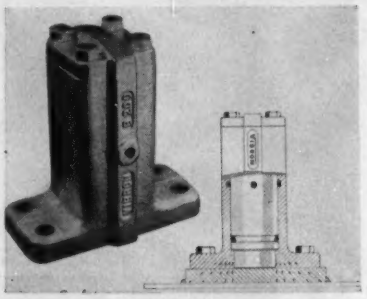
1016 • Air-cooled unit incorporates automatic voltage stabilization and remote stepless reactor control. Output voltage is controlled by reactor, eliminating moving parts, reducing maintenance costs and downtime. Voltage is maintained automatically, regardless of changes in tank load or variations in ac line voltage. Special control for anodizing is available.

Automatic voltage stabilization maintains correct voltages needed for closer plating tolerances. Power settings can be fingertip controlled.

Reactor control system has magnetic amplifier that signals control reactor to make adjustment whenever actual voltage is different from desired voltage set at remote control station.

Units occupy less than 9 sq ft of floor space, have ratings from 6 to 24 volts and up to 4000 amps.

General Electric Co, Rectifier Dept, Lynn, Mass.



Shock column vibrator

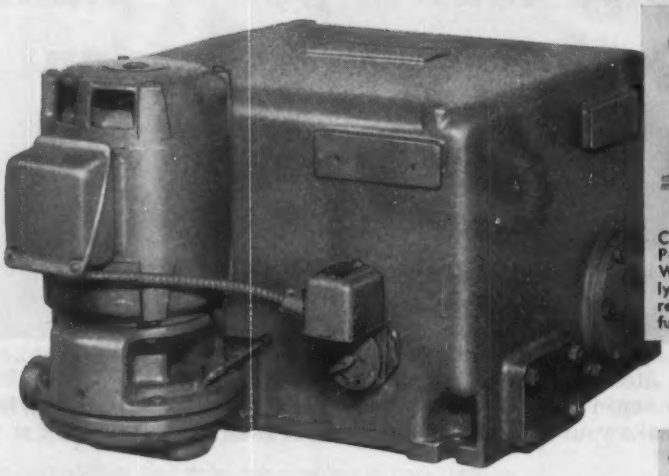
1014 • "Mono-coque" in body design, this vibrator is said to eliminate on-the-job hazard of bolt breakage.

Heart of this unit is a combination of high strength one piece body incorporating high compression drive and a new shock column impact system. Unit uses Vibron high compression cycle in place of conventional air cushioning to drive piston against anvil. In turn, maximum impact against anvil is assured at all times according to manufacturer, through full utilization of Vibron shock column design plus improved methods of precision machining. Vibrator is manufactured in a full range of sizes. Request complete details.

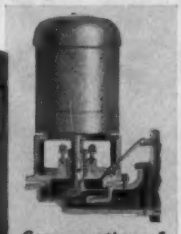
Burgess Sterbentz Corp, 3790 W 150th St, Cleveland 11, Ohio

HOFFMAN

CONDENSATION PUMPS



Type "HCS" and "HCD"



Cross section of Pump assembly. Water flows directly from cast iron receiver into centrifugal pump.

Single & Duplex Units—Ratings through 150,000 sq. ft. E.D.R. Watchman Pump—a small compact unit for capacities of 500 to 8,000 sq. ft. E.D.R. and 20 lbs. Discharge Pressure.

featuring— • **Compact Design** • **Low Suction Velocities** • **Bronze Fitted throughout** • **Stainless Steel Shaft** • **No piping between pump and receiver** • **Rigid motor support for quiet operation** • **Cast iron receiver**

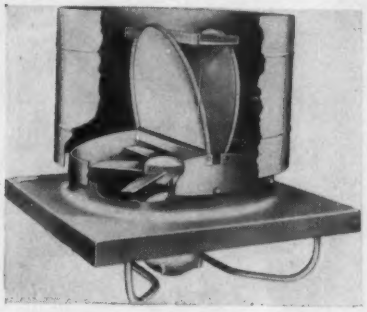
Motor and Pump unit is designed vertically to place the motor high above the floor—away from dirt and water. Standard ball bearing motors are used.

HOFFMAN SPECIALTY MFG. CORP.

A COMPLETE LINE OF STEAM AND

F&T Traps Steam Vents Supply Valves

Begins on page 158



Industrial roof ventilator

1031 • Industrial roof ventilator is said to provide fresh air and fight fire. Airfoil fan blades welded to specially designed hub insure maximum exhaust of heat, smoke, dust and fumes at low rpms, according to manufacturer.

Ventilators can be furnished with fusible link device which acts as an emergency damper opener during fires. This safety vent device is completely independent of fan operation. Spring is shielded from flames by damper blades to prevent annealing and loss of tension from heat. Butterfly dampers open automatically during fan operation but weather-seal ventilator during non-use.

During fan operation, exhaust air is dissipated with sufficient velocity to exclude rain or snow and prevent exhaust re-entry. Eight sizes are available. Blade diameters run from 24 to 60 in. Varied motor outputs offer an exhaust capability range of 6640 to 53,700 cfm.

Detroit Blower Co, 9257 Pacific Ave, Franklin Park, Ill.

For more details on these items, use post cards p 165. Identify your request with item number.

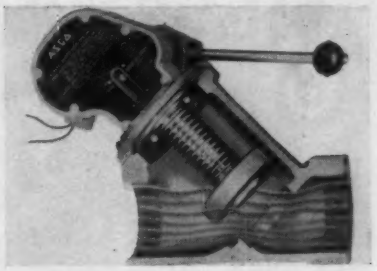
Centrifugal pumps

1012 • Centrifugal pumps are constructed of 316 stainless steel; this includes all parts in contact with solution being pumped, shafts and fasteners. Supporting pedestals, protective shaft sleeves and impellers may, if desired, be selected from other wear and corrosion-resistant alloys.

The single-stage, single-suction units are stocked, completely assembled with maximum diameter impellers and are available for immediate shipment with or without base and coupling for NEMA frame motors. Manufacturer also offers various deviations from standard off-the-shelf pumps.

Available in sizes from 1½x1¼ in., to 4x3 in. with capacities to 600 gpm and heads to 160 ft.

Ampco Metal Inc, 1745 S 38th St, Milwaukee 46, Wis.



Safety shut-off valve

1035 • Manual reset solenoid valves are used in gas supply lines leading to boilers, furnaces, ovens and other heating equipment to shut off fuel automatically and instantly upon failure of power. Sizes range from 1¼ to 3 in. These sizes meet requirements for safety shut-off valves (on gas service) in safety codes. Approval on other sizes and service are pending, according to manufacturer.

Valves are designed to control flow of manufactured, natural and L-P gases in a maximum ambient of 104 F. They can also be used to handle various grades of fuel oil and non-corrosive liquids, gases.

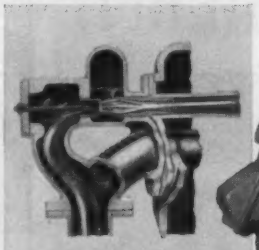
Automatic Switch Co, 391 Lakeside Ave, Orange, N. J.

HEATING PUMPS

VACUUM PUMPS

Single and Duplex Units—Ratings through 100,000 sq. ft. E.D.R. Hoffman famous Jet Vacuum Producer assures greater efficiency—low upkeep. Cuts operating time and power bills approximately ½.

• Engineered to remove up to 300% of rated capacities of air at start of heating cycle • Shorter warm-up period means economies • Standard Capacity for ordinary requirements—Special Capacity where larger air and water capacities are necessary • Cast iron receiver



Jet Vacuum Producer enables Hoffman Pump to handle almost boiling water. Cross section view shows air, vapor and condensate from Accumulator Tank entrained by Jet and being discharged to Air Separating Tank.

Single Unit showing high motor mounting and close coupled pump

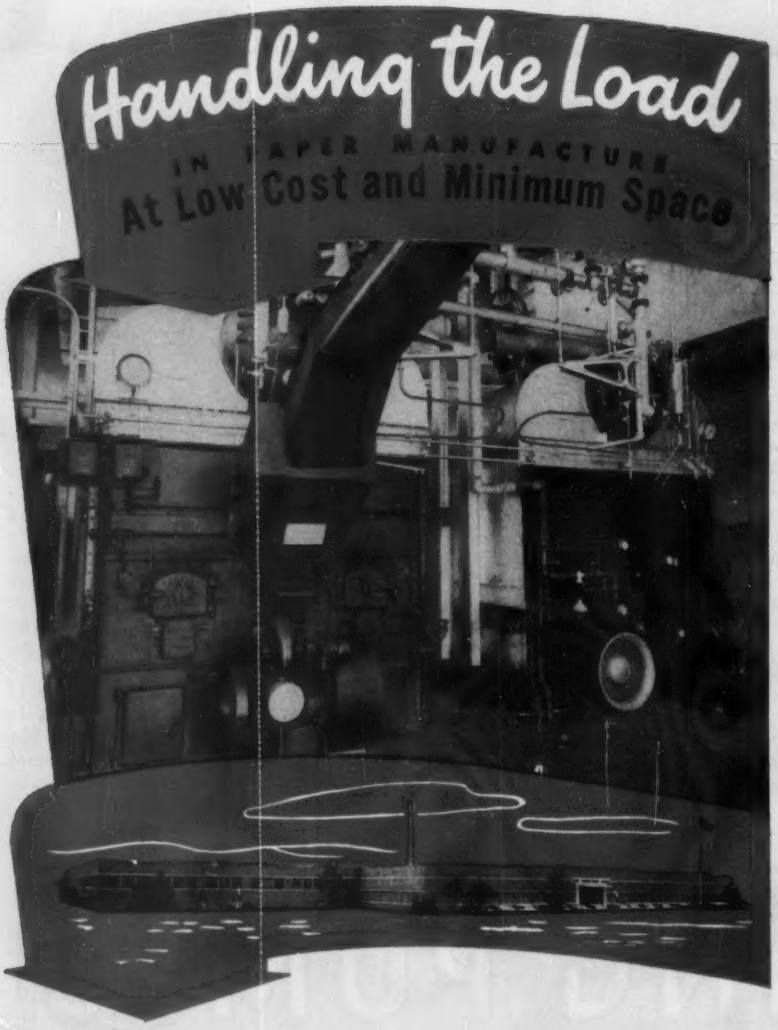
HOT WATER HEATING SPECIALTIES

Circulating Pumps

Balancing Elbows

Water Vents

Sold by Leading Wholesalers of Heating and Plumbing Equipment



TITUSVILLE TICOTHERM

STEAM GENERATORS

For Paper Manufacturers Company, at their Bustleton, Pa. plant, two main types of firing are handled efficiently by these Titusville TICOTHERM Steam Generators. No. 1 boiler has a ram-type underfeed stoker, No. 2 is equipped with oil burner for standby, providing flexibility for all processing and heating needs of the large plant pictured.

Write for your copy of informative Ticotherm Bulletin B-3250A —sent promptly on request.

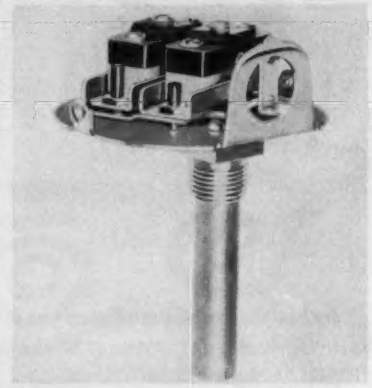
THE TITUSVILLE IRON WORKS COMPANY
TITUSVILLE, PA.

A division of Struthers Wells

Manufacturers of A Complete Line of Boilers for Every Heating and Power Requirement

More EQUIPMENT NEWS

Begins on page 158



Thermostat controls 2 circuits

1052 • *Series 22000* thermostat can control two independent electrical circuits simultaneously. Basically, it consists of a liquid-filled sensing element, containing a sensitive bellows-and-push-rod assembly that actuates two precision miniature snap switches mounted in the head. Each switch may be connected to operate a separate electrical circuit.

The thermostat can be specified to operate over the following service temperature ranges: –75 to 125 F; 25 to 225 F; 100 to 300 F. Each switch can be set in the field to actuate at any temperature within the service range. With the differential setting arrangement, adjustable in the field, the second switch will operate at a predetermined number of degrees above or below the setting of the first. Differentials between the switches may be specified from 0 to 200 F. Switches are available to handle up to 20 amp at 125 or 250 volts ac or 10 amp at 125 volts dc.

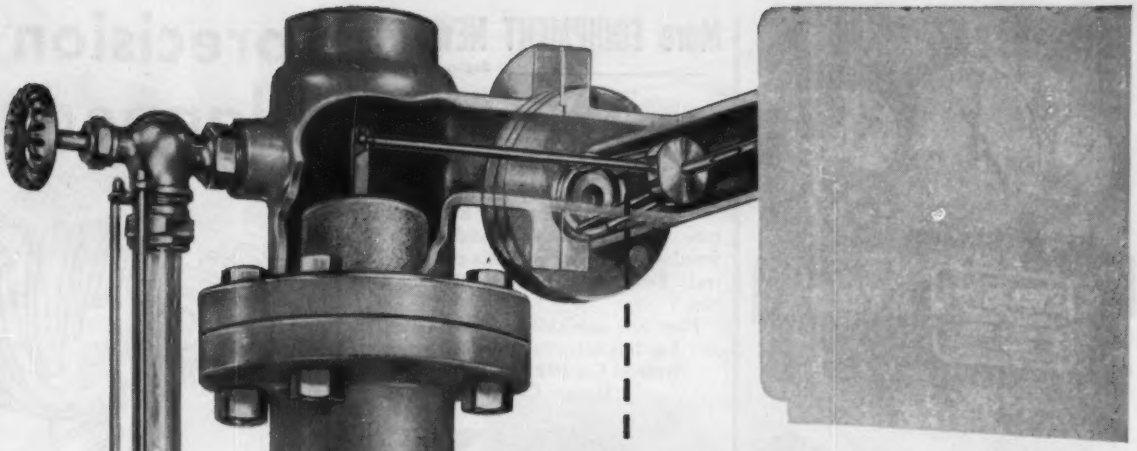
Fenwal Inc, Ashland, Mass.

For more details on these items, use post cards p 165. Identify your request with item number.

Selenium Rectifiers

1018 • Cartridge-type selenium rectifiers are specifically designed for low current, high voltage problems. Miniature rectifier stacks are ideal for use in condenser storage devices, cable testing, bias supplies, oscilloscopes, Geiger-Muller Counters, etc. They are rated at five milli-amperes dc and feature low leakage current in reverse direction, low forward drop in conductive direction and a wide frequency range between 0 and 1000 cycles per circuit. No filament transformers are needed, no warm-up time is required according to manufacturer.

Vapor deposition process insures uni-

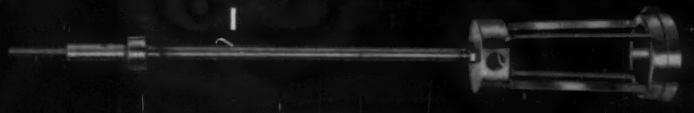


NOW... no knife edges to cut performance

NEW... Displacement-Type LIQUID LEVEL CONTROLLER

Nobody thought it could be done: In one sweeping new approach Kieley & Mueller has eliminated the knife edge . . . biggest trouble spot in displacement principle instrumentation.

In place of knife edges which dull in time, the K&M Flexotrol introduces the *torque table*. It's perfectly centered always . . . requires less torque. It's free-turning . . . only 4° required. Yet it doesn't have a single spot for gunk to collect requiring maintenance, affecting accuracy. A torque tube is employed . . . still the controller is



actuated by a torque rod that does not twist. Both torque tube and torsion table legs are Inconel-X . . . a special material resisting corrosion and fatigue alike. Five million cycles has shown no detrimental effect.

The full story is in Bulletin 456-1. Send for your copy.

For installation and operating convenience, the *Flexotrol* Controller is reversible and rotatable . . . but something more: optional mechanical indication, independent of the pneumatic system, is your final and positive check. Available with all control features including automatic reset.

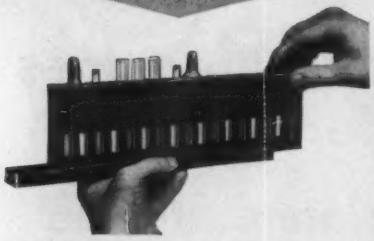
KIELEY & MUELLER, INCORPORATED

K&M

64 Genung Street • Middletown, New York

diaphragm control valves and regulators for over 75 years

ACCURATE
pH, PHOSPHATE
CONTROL
with
TAYLOR COMPARATORS
REDUCES WASTE



Help determine EXACT amounts of chemicals needed for adjustments

By making accurate colorimetric tests of pH and phosphate content with Taylor Comparators, you can be sure of determining the exact amounts of chemicals needed to control scaling, corrosion and priming in boilers. Tests can be made in minutes—no experience is needed. Just fill test tubes with sample, add reagent to center tube and move color slide across until colors match. Even complete water analysis is only a little more detailed with the Taylor Water Analyzer.

Water hardness may be determined with the ease and accuracy of an alkalinity titration with the Taylor Total Hardness Set.

COLOR STANDARDS GUARANTEED

Taylor liquid color standards carry an unlimited guarantee against fading. There's no chance of mechanical inaccuracy. Each complete set of standards is mounted in a lightweight, plastic slide, eliminating the need for handling fragile, single standards.

SEE YOUR DEALER for Taylor sets, or write direct for FREE HANDBOOK "Modern pH & Chlorine Control." Gives theory and application of pH control, and illustrates and describes complete Taylor line.

W. A. TAYLOR AND CO.
YORK RD. & STEVENSON LANE • BALTO. 4, MD.

More EQUIPMENT NEWS

Begins on page 158

formity, stability and long life to these rectifiers.

Cells are securely mounted in a hard glass tube with a helical steel spring at one end to provide contact. Ends of glass tube are hermetically sealed by metal ferrules using a porcelain-glass-to-metal seal. Ferrules fit standard 30 amp fuse clip.

They are conditioned for operation in salt fog, tropical areas and high altitudes.

Syntron Co, 492 Lexington Ave, Homer City, Pa.

Liquid level gage

1053 • Gage lights up and flashes red continuously to warn when boiler water level is too high or too low. Gives instant remote reading of liquid levels of boilers, tanks, etc, with accuracy of ½ of 1 percent of scale reading, according to manufacturers. Brings liquid level to a point where it can readily be seen. Has a convex face, with scale marking directly on the face, giving 180 deg visibility. Can be equipped with signal horns, lights and up to six repeaters for signalling the operating floor. Request full details.

Jerguson Gage and Valve Co, 80 Fellsway, Somerville 45, Mass.

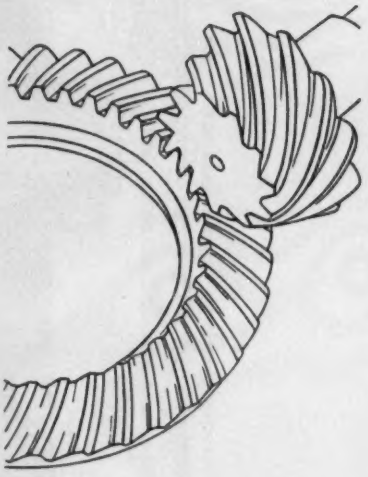
For more details on these items, use post cards p 165. Identify your request with item number.

Mixer and unloader

1032 • *Type B* continuous mixer and unloader removes and treats ash and other dry materials. Unit continuously mixes material with water and discharges properly moistened mixture into waiting trucks or rail cars.

Unit is suspended from base of storage

precision lapped



Philadelphia
GEARS
world standard of excellence

To assure you of the *ultimate in surface finish and tooth bearing*, we have special lapping machines for all straight bevel, spiral, bevel, Hypoid and Zerol gears. These machines hold the gears at the *proper distance* while lapping, and this distance is permanently etched onto the gears to facilitate assembly.

We also have equipment for lapping spur, helical, double-helical and continuous tooth herringbone gears on specified centers... Of course, Philadelphia lapped gears run smoother, operate at highest efficiency and last longer in service.

Send for our new 76-page Gear Book... Please use your Business Letterhead.

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PHILADELPHIA GEAR WORKS, INC.
ERIE AVE. & G STREET, PHILADELPHIA 34, PENNA.
Offices in all Principal Cities

INDUSTRIAL GEARS & SPEED REDUCERS
LIMITORQUE VALVE CONTROLS
FLUID AGITATORS • FLEXIBLE COUPLINGS

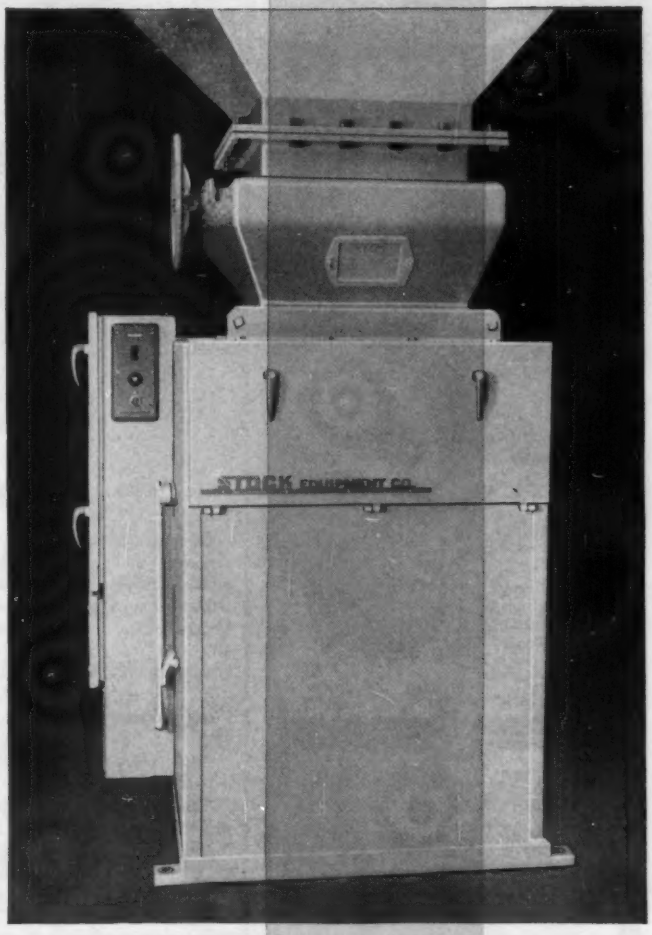
Virginia Gear & Machine Corp. • Lynchburg, Va.

See the newest developments in Mechanical Power Transmission at our Booth #80—22nd. National Power Show, New Coliseum, New York City, November 26-30.

24"

STRAIGHT THROUGH

No Restrictions . . .
No Baffles . . .
No Sloping Skirts



The *new* **S-E-Co. Model 50 Coal Scale** has been designed to eliminate coal stoppage difficulties. This scale makes it possible for you to get maximum accuracy of weight of coal burned for boiler tests, to keep inventory records, and to balance mills without danger of coal plugging and hanging up.

The inlet of the Model 50 is 24" inside square — the vertical feeder skirts carry a 24" stream of coal — and the stainless steel weigh hopper has a 24" wide outlet.

In addition, the large, rigid and well gasketed doors of the Model 50 maintain a clean installation that is easy to service. Roller bearings on the weigh hopper gate and other carefully worked out improvements make this scale of tomorrow the scale for you today.

SPECIALISTS IN
BUNKER TO PULVERIZER AND
BUNKER TO STOKER EQUIPMENT

STOCK Equipment Company

745-P HANNA BLDG., CLEVELAND 15, OHIO

PRESSURE & TEMPERATURE
SAFETY
PROTECTION

MERCOID®
MERCURY SWITCH EQUIPPED
CONTROLS

SERIES "D"
FOR PRESSURE & TEMPERATURE

Over a million of these mercury switch equipped controls are in use throughout every industry in the world SAFE-GUARDING costly equipment against HAZARDOUS pressure and temperature conditions.

Pressure types are available in 17 pressure ranges from 0-30" vacuum to 300-2500 psi with the sensitivity your application requires. Temperature types range from minus 30° to plus 60° F., up to 370-530° F. with varying sensitivities dependent upon range selected.

All types are bourdon tube operated and are equipped with external adjustments, visible dial and the famous Mercoid sealed mercury contact.

FOR ALL TYPES OF SERVICE

FOR GENERAL PURPOSE Nema 1

WEATHER-PROOF OUTDOOR SERVICE Nema 1A, 2, 3, 4

EXPLOSION-PROOF HAZARDOUS LOCATIONS Class 1, Group D Class 2, Group E, F, G.

Our engineers are at your service—send in your control problem or WRITE FOR CATALOG 700B

THE MERCOID CORPORATION
4211 Belmont Ave., Chicago 41, Ill.

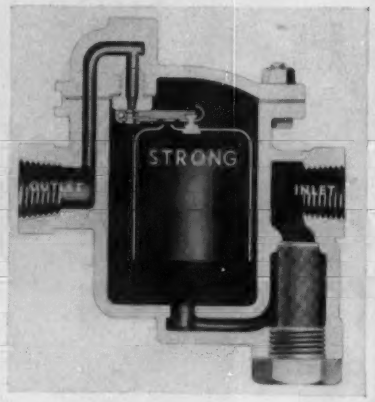
More EQUIPMENT NEWS

Begins on page 158

bin, permitting operator to watch discharge and regulate water and feed controls for the right material-water consistency.

Mixer-unloader is shorter in overall height. Unit is self-contained and may be lowered by a hoist for maintenance and overhaul at floor level. Rotary feeder is used to control flow of fine grain material to unit. Adjustable feed-control baffle is used for dry mixtures of larger size material. Details from manufacturer.

Allen-Sherman-Hoff Co, 259 E Lancaster Ave, Wynnewood, Pa.



Steam trap with strainer

1021 • *140-S Hydro-Flex* steam trap has built-in stainless strainer which prevents clogging and reduces cleaning maintenance time, according to manufacturer. Other features are: small size and weight, bucket action for efficient operation under all load conditions, durable semi-steel body and all stainless-steel working parts.

Strainer is located on inlet side to catch foreign matter before it has a chance to clog trap. Strainer screen is installed in vertical position and may be easily removed for cleaning.

The S traps are suitable for working pressures up to 150 psig. Inlet and outlet tapped hole sizes are ½ and ¾ in.

Strong, Carlisle & Hammond Co, 1392 W 3rd St, Cleveland 13, Ohio

For more details on these items, use post cards p 165. Identify your request with item number.

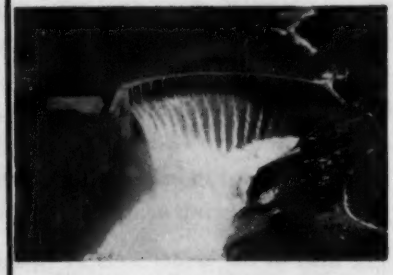
Eyesaver slide rules

1034 • Light alloy slide rule has green-yellow color designed to cut eyestrain, blurring, and errors in reading. Manufacturer points out that green-yellow shade coincides with optimum sight point of spectrum, eliminating violet and red rays that focus in front of and behind retina. Corrosion-resistant metal construction avoids warping, swelling and binding. Available in 6- and 10-in. trig and log-log standard rules or in rules made to special order. Catalog on request to manufacturer.

Pickett & Eckel, Inc, 1109 S Fremont, Alhambra, Calif.

From the SMALLEST...
to the LARGEST

MURCO
MURCO GATE HOISTS



MURCO Gate Hoists are designed for any size power dam and built in a wide range of capacities—from over 100 tons down to less than 1 ton . . . from the largest motor operated gate hoist to the smallest hand operated hoist . . . back of every MURCO Gate Hoist are over 70 years of designing and building gate hoists. From this experience we have accumulated designs and patterns that may fit your requirements. In planning power dam gates, we suggest you write us before your plans for the project as a whole are completed . . . it may save you expense and important preparation time.

Write for complete information and Engineering Department recommendations.

D. J. MURRAY MANUFACTURING CO.
MANUFACTURERS SINCE 1883
WAUSAU, WISCONSIN

for Faster Start-ups and Greater Economy

THIS 7,000 kW Brown Boveri Gas Turbine was installed in November, 1954 at the Vermilion, Alberta, Canada power station of Canadian Utilities, Ltd.

in PEAK LOAD and BASE LOAD SERVICE

BROWN BOVERI

single shaft, 7,000 kW, open cycle

GAS TURBINES

BROWN BOVERI

THE Brown Boveri 7,000 kW single shaft gas turbine is the answer to the rigid demands of Peak Load service. Relatively no warm-up time is required . . . full load can be reached in 15 minutes or less.

In-the-field performance records of over 50 such units—in peak and base load service throughout the world—prove their economy of operation. They require a minimum of manpower and maintenance; they burn any gaseous or liquid fuel; and they effect economies in building construction, foundations and overall capital outlay.

Whether yours is the problem of peaking or base load service in a public utility, cooperative, or industrial power plant, you'll find it profitable to investigate Brown Boveri Gas Turbines.

BROWN BOVERI CORPORATION

19 RECTOR STREET • NEW YORK 6, N. Y.

Atlanta, Ga. • Birmingham, Ala. • Boston, Mass. • Buffalo, N. Y. • Butte, Mont. • Chicago, Ill. • Cleveland, O. • Denver, Colo. • Detroit, Mich. • Hamilton, O. • High Point, N. C. • Houston, Tex. • Jacksonville, Fla. • Kansas City, Mo. • Knoxville, Tenn. • Lewiston, Me. • Miami, Fla. • Minneapolis, Minn. • New Orleans, La. • New York, N. Y. • Pasadena, Cal. • Portland, Ore. • Roanoke, Va. • San Francisco, Cal. • Seattle, Wash. • Syracuse, N. Y. • Tucson, Ariz.

WIEDEKE

Announces Its NEW General Catalog

TUBE EXPANDERS

TUBE CUTTERS

ACCESSORIES

Write for New Catalog 81

for

Fire Tube Boilers
Water Tube Boilers
Condensers—Coolers
Heat Transfer Units
Refinery Still Tubes
Miscellaneous Tube Units

(32)

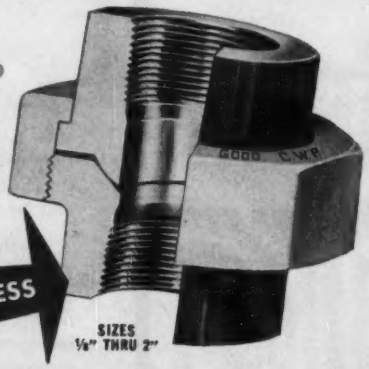
The Gustav WIEDEKE Company
Dayton 1, Ohio

NEW petro

6000 LBS. C.W.P.

FORGED STEEL UNIONS

Ideal for High Pressures of Gases or Liquids, Hot Oils, High Temperatures, Ammonia Hot or Cold & Power Piping



HEAVIER WALL THICKNESS

SIZES ⅛" THRU 2"

- The wall thickness of this New Petro Union has been greatly increased to easily withstand the severe demands of higher pressures and hot or cold temperatures. It is drop forged from uniformly heated steel forging bars. Grain and fibre structure are refined through the controlled hammer impact on the hot, plastic metal as it is confined in the closed dies. The hot forging develops the tensile and torsional strength, the toughness and fatigue endurance required to enable the finished Union to resist the most complex stresses and strains ever present in high pressure and high temperature piping systems.
- Nuts are octagon in shape and are Udylited. The nut threads are rust-proof, spark-proof and permanently lubricated with Udylite Cadmium.
- The ends are also octagon in shape to provide flat gripping areas for wrenches.
- The ends are tapped, sharp and clean, per American Standard B 2-1 1945 (for tapered pipe threads).

THE "ECONOMY PLUS" UNION

You'll get greater ruggedness, dependability and service with a minimum of downtime or maintenance time. Considering the original low cost it's the most economical Union you will ever buy.

MAIL THIS COUPON TODAY!

PLEASE SEND US COMPLETE INFORMATION ON THE 6000 LB. PETRO

NAME_____

ADDRESS_____ CITY_____ ZONE_____ STATE_____

CLAYTON MARK & COMPANY • 1900 Dempster Street • Evanston, Illinois

More TECHNICAL BRIEFS

Begins on page 152

undertaken, but the paper gives a brief review of preliminary estimates. Information is also given on installed capacity of electrical power plants and their production, and on utilization of natural heat and consumption of imported fuels. *WPC paper No. 163A28.*

Energy resources in India. *By The Central Water and Power Commission, Government of India.*

This paper reviews the principal energy resources of India—coal, lignite and water. The coal resources are discussed in their various aspects—main types of bearing strata in India, resources of coking and non-coking coals, and output and demand for coal. The utilization of coal for power generation is discussed and it has been stated that limited resources of high-grade coal are being conserved by utilizing low-grade coal in all future installations of steam power plants.

The schemes for exploitation of the lignite deposits as recommended to the government of India are mentioned. An estimate of the South Arcot lignite reserve and its quality is brought out.

Schemes for the utilization of lignite to produce electric power and ammonium sulfate are explained. The use of raw lignite briquettes as domestic and industrial fuel is described.

The water-power resources of the country have been assessed on the basis of a survey made by the Central Water and Power Commission. The potentials of (a) west-flowing streams of the western Ghat, (b) east-flowing rivers of southern India, and (c) rivers of the Central Indian Plateau are discussed. *WPC paper No. 178A30.*

Electric motors

Major auxiliary drive motors in steam-electric power plants. *By A E Beardmore, General Electric Co.*

In applying motors to any auxiliary drive care must be exercised to obtain accurate torque and inertia characteristics of the driven equipment and the voltage variations with which the motor must operate. This paper discusses requirements of the driven machine power supply ambient conditions and motor enclosures, insulation, noise, applications, etc. *APC paper; no number.*

Applying industrial controllers for safe operation. *By G W Heumann, General Electric Co.*

Safety of operation is discussed in

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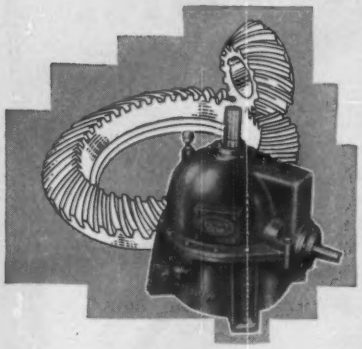

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Begins on page 152

this paper. Important considerations are enclosures to avoid fire hazard from contamination of industrial atmospheres and coordination of controller interrupting ability with the short-circuit capacity characteristic of the power system to avoid the possibility of explosive failure of the equipment. Items discussed include enclosures for industrial use, adequate interrupting capacity controllers, accidents and high-interrupting capacity controllers. *AIEE paper No. 56-269.*

Motor starting problems on industrial distribution systems. *By H W Cory, Allis-Chalmers Mfg Co.*

The most important point in selecting the type of starting to be used is the power-line stability. Low line voltage during starting and normal operation of motors is the most common and most damaging hazard to power distribution systems. The most important steps which can be taken to improve voltage conditions during starting, without changes in existing equipment, are planned starting of motors and proper correlation of motor starting methods and motor design. Also discussed is selective starting, reducing starting current, autotransformer starting, primary reactor and resistor starting and wound-rotor motor starting. *APC paper; no number.*

High voltage motor controllers for the petroleum industry. *By Thomas Render, General Electric Co. AIEE Conference paper; no number.*

Rectifiers

Sealed ignitron principles extended to larger tubes. *By J L Boyer and A P Colaiaco, Westinghouse Electric Corp.*

Universal acceptance of the sealed ignitron for industrial power rectifiers up to 1000 kw at 600 v raised the question of the possibility of larger ignitrons for higher ratings. Sealed tubes are now available at ratings up to 1000 amp at 250 v dc. Good designs of sealed ignitron rectifier units can be obtained with ratings up to 2000 kw for 6 tubes at 600 v. Even larger installations can be obtained by operating the high-capacity rectifiers in parallel. *AIEE paper No. 56-173.*

A new method for reducing arc-back currents in rectifiers. *By A Schmidt Jr, General Electric Co and L J Harris, Aluminum Company of America.*

As rectifier stations feeding electrochemical installations become larger

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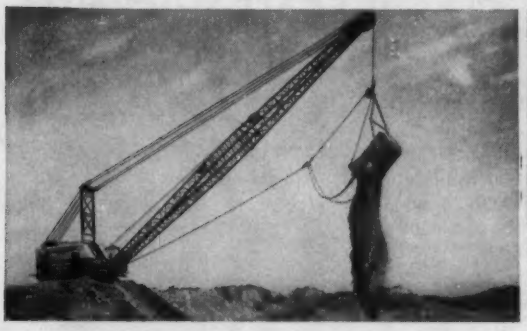

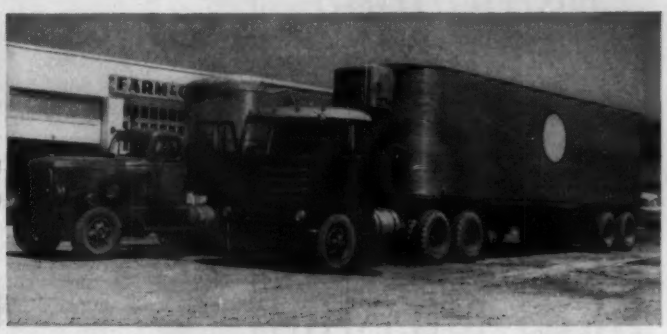

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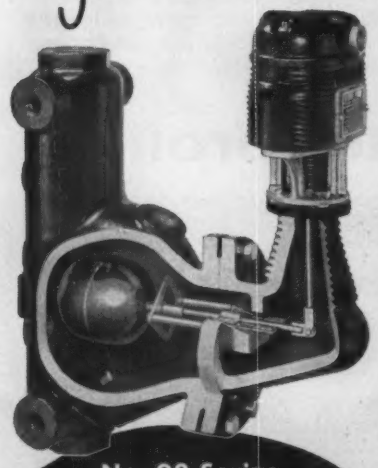

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and available short-circuit kva from the power system becomes greater, the increased duty on rectifier switchgear presents a serious problem. If the rate of rise of current in a backfiring anode can be kept below 10 million amperes per second, present-day switchgear will limit fault currents to about 50,000 amps. This should be considered the maximum acceptable.

Items discussed include anode reactors, field tests, transient analyzer tests and voltage surges. *AIEE paper No. CP56-189.*

Other electrical papers

Hunting of a salient-pole synchronous machine during starting. *By C Concordia, General Electric Co. AIEE paper No. 56-1.*

Current rating of aluminum multiplex cable. *By L F Roehmann, Kaiser Aluminum & Chemical Corp. AIEE paper No. 56-8.*

Analysis of instability and response of reactors with rectangular hysteresis loop core material in series with capacitors. *By J T Salihi, University of California. AIEE paper No. 56-10.*

Electrical inspection of petrochemical plant construction. *By N D Casdorph and J H Wieting, Carbide & Carbon Chemicals Co. AIEE paper No. 56-14.*

The application of reactance in the design of steel mill distribution systems. *By G B Scheer, Kaiser Engineers. AIEE paper No. 56-66.*

A new approach to the calculation of synchronous machine reactances—Part II. *By M E Talaat, Elliott Company, AIEE paper No. 56-56.*

New type current transformers for low oil content—circuit breaker. *By A N Arman, Pirelli-General Cable Works, Ltd, and W H Clagett, Pacific Oerlikon Co. AIEE paper No. 56-35.*

Corrosion

Inhibiting corrosion of steel, aluminum and magnesium intermittently exposed to brines. *By George E Best and John W McGrew.*

Prevention of corrosion of metals under continuous exposure to sodium or calcium chloride refrigerating brine is one of the earliest commercial uses of a chemical inhibitor. Yet comparatively little has been published about the effectiveness of inhibitors under condi-

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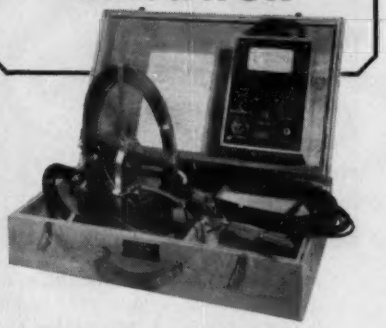

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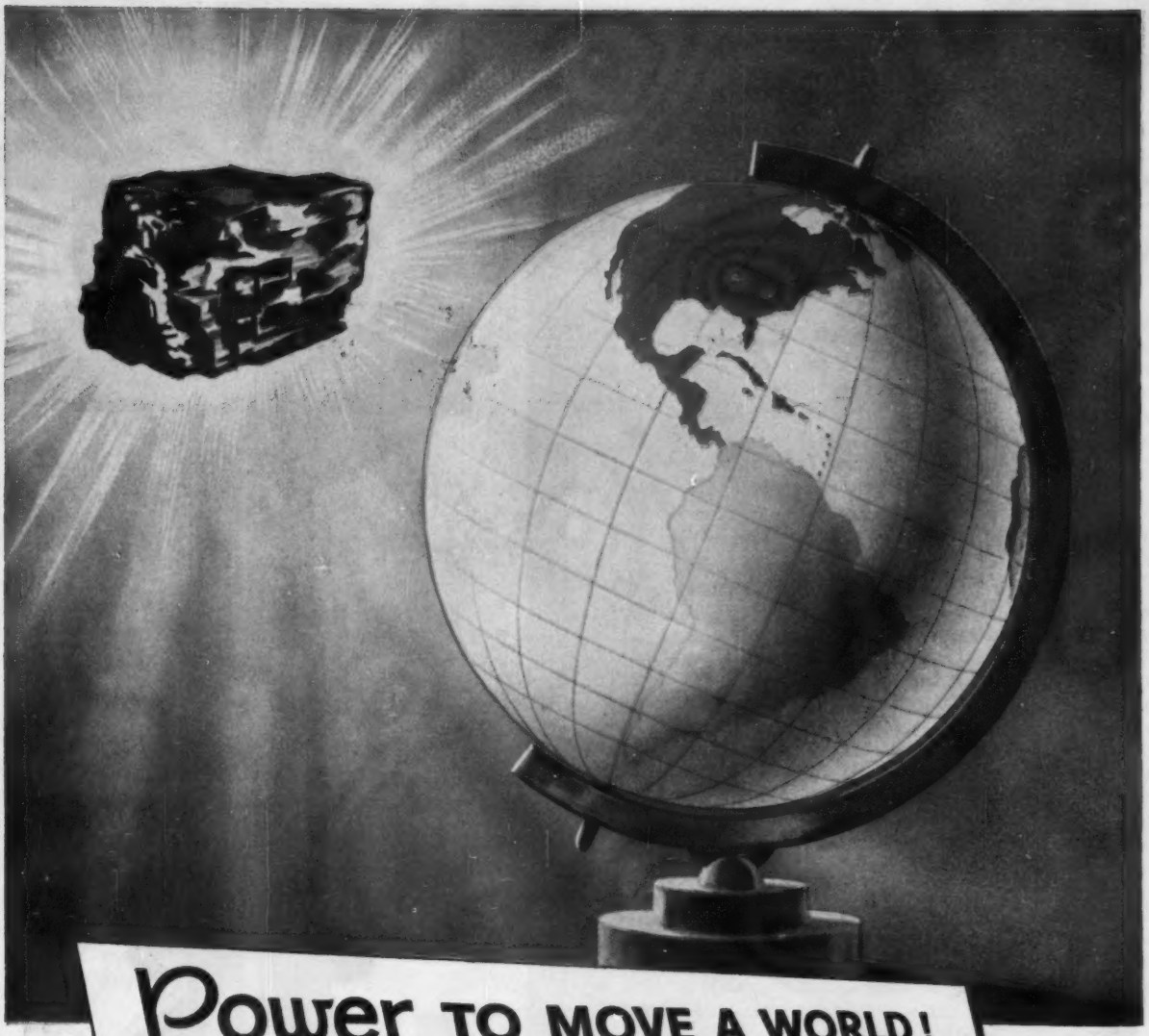

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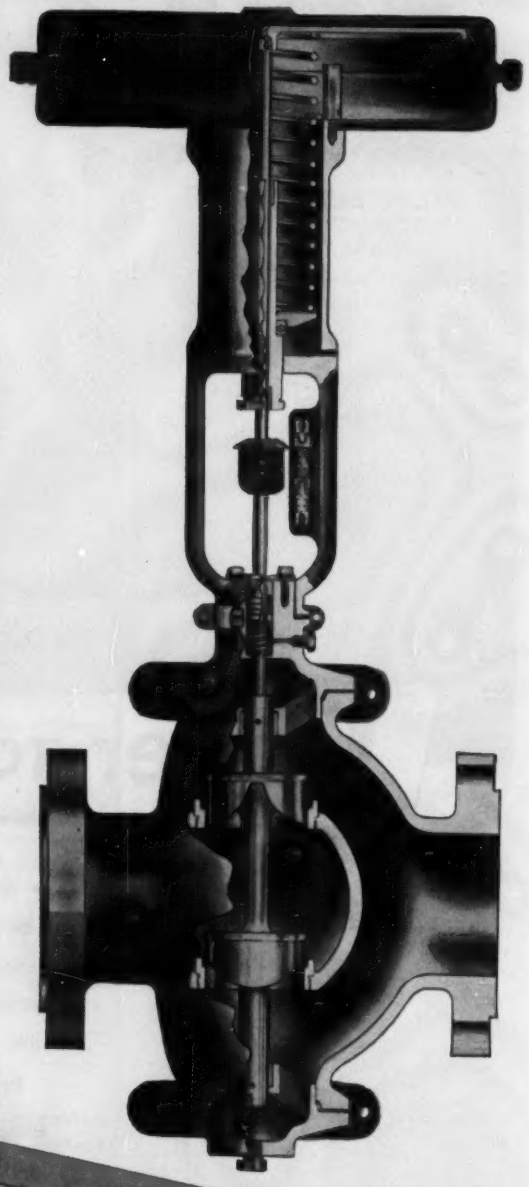

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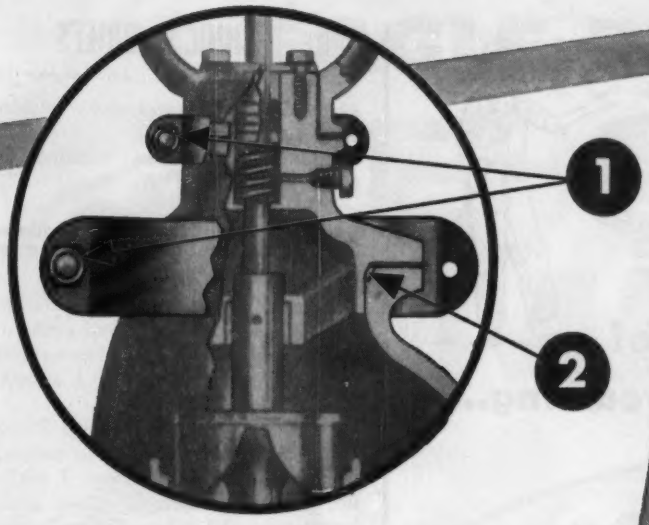

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tions of discontinuous exposure.

Using an experimental technique to provide comparative data and indicate orders of magnitude rather than precisely determined corrosion rates, the present work establishes that chromate effectively minimies brine corrosion of mild steel and selected aluminum and magnesium alloys intermittently exposed to brines at ordinary temperatures. Importance of ratio between metal surface area and test solution volume is brought out, as is effect of pH through comparison of chromate with bichromate. Quantitative indications of inhibitor consumption are reported. *NACE paper No. 4.*

A refinery paint program to cut maintenance costs. *By R J Hafsten, H A Homan and K R Walston.*

This paper illustrates results of an organized effort to reduce refinery maintenance painting costs. Surface preparation is emphasized and importance of an adequate mil thickness is illustrated. Tests conducted in the refinery and test panels exposed in high ultraviolet sunlight at Coral Gables, Florida are used to evaluate paint quality. Control is exercised over the field thinning of paint in order to assure a uniform coating and adequate mil thickness. A card system gives a permanent record of each tank coating applied. Cost data are computed and analyed for each year. These figures are combined with service life to find cost per square foot per year. Calculations show that although initial cost was slightly higher effects of the program are now being realized and a reduced cost of $48,500 per year will be obtained. *NACE paper No. 7.*

Corrosion studies in high-temperature water by a hydrogen effusion method. *By M C Bloom, M Krulfeld, W A Fraser and P N Vlannes.*

A new measurement method for static corrosion rates in aqueous systems at elevated temperature and pressure is briefly described. Data obtained by application of the method to ferrous systems are presented. These data include: corrosion rate of low carbon steel in distilled water at 600 F.; effect of raising pH in such systems; effect of thermal shock and temperature rise on corrosion rate; effect of heat treatment of metal on corrosion rate. Comparison is made between corrosion rates of low carbon steel and stainless steel and some data are included on

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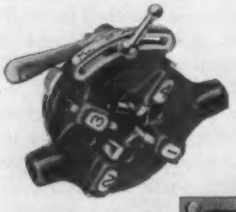

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effect of wall thickness of low carbon steel specimens on rate of hydrogen effusion resulting from corrosion at 600 F. *NACE paper No. 10.*

Corrosion of stainless steels in supercritical water. *By H A Pray and W K Boyd.*

Behavior of ten stainless steels, including both hardenable and nonhardenable grades in degassed supercritical water at 800, 1000 and 1350 F at 5000 psi, is tabulated.

In general, corrosion at 1350 F was found to be intergranular in nature; while at 1000 F only *Inconel X* exhibited selective penetration along grain boundaries. All alloys suffered some decarbonization and carbide precipitation after exposure to supercritical water at 1350 F. No significant phase changes were observed at 800 and 1000 F.

The *Armco 17-4 PH, Armco 17-7 PH,* and *Hastelloy F* alloys were the most resistant materials at 1350 and 1000 F. All alloys evaluated had excellent resistance to 800 F degassed supercritical water. *NACE paper No. 12.*

Corrosion-resistant aluminum alloys for use in water at elevated temperatures. *By J E Draley and W E Ruther.*

Commercial aluminum alloys suffer rapid disintegration in water at temperatures significantly above 200 C. The phenomenon can be prevented by anodic protection. One practical method is by alloying the aluminum with nickel. Such alloys suffer only "normal" attack, showing only moderate corrosion rates. Corrosion properties and rates are given for these alloys and effects of other alloying constituents are described. *NACE paper No. 13.*

Aluminum alloys for handling high purity water. *By W W Binger and C M Marstiller.*

Aluminum alloys have been used for storage and distribution systems handling distilled water for over twenty years. Recently, it became possible to investigate experience with some 30 distilled water systems that had been in use for various periods up to 24 years. Many of these systems had been made entirely of aluminum, several were entirely of tinned copper or brass and others were a combination of materials including aluminum.

Results indicate that aluminum alloy storage tanks, tubing, fittings and valves are highly satisfactory for handling distilled water and do not cause sig-

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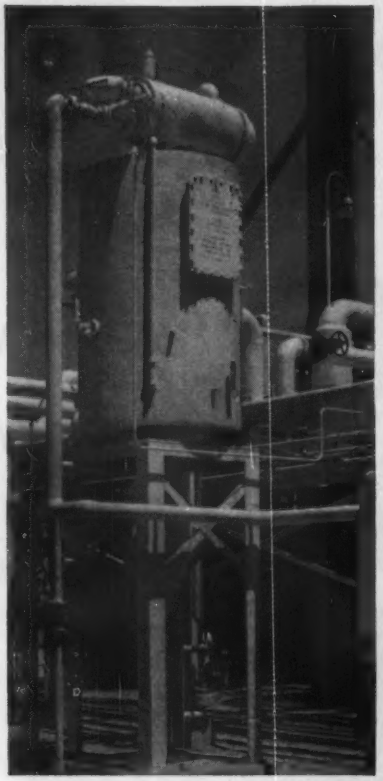

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nificant contamination of water being handled.

The ion-exchange method for purifying water requires equipment fabricated from materials in which such a water could be handled with a minimum of pick-up and discoloration. Since many processes require large quantities of a water of very low total solids content, it was natural to consider aluminum alloys for fabrication of storage tanks and piping for handling demineralized water because of the many successful uses of aluminum alloys handling distilled water. *NACE paper No. 14.*

TO OBTAIN COMPLETE TEXT

Material for these abstracts comes from the following sources unless otherwise stated. Order complete paper from source, not POWER.

American Society of Mechanical Engineers. Identified by initials ASME and obtainable through ASME, 29 W 39th St, New York 18, New York.

American Institute of Electrical Engineers. Identified by initials AIEE and obtainable through AIEE, 33 W 39th St, New York 18, New York.

American Power Conference, 18th annual meeting. Identified by initials APC and obtainable through purchase from Director, APC, Illinois Institute of Technology, Chicago 16, Ill.

National Association of Corrosion Engineers, 12th Annual Conference. Identified by initials NACE. For further information contact NACE, 1061 M & M Building, Houston 2, Texas.

World Power Conference, 5th meeting, identified by initials WPC. Information as to availability obtainable from Oesterreichisches Nationalkomitee der Weltkraftkonferenz, Vienna I, Schwarzenbergplatz 1, Austria.

Federal Power Commission has authorized Gulf Interstate Gas Co, Houston, Texas to make its experimental unattended "satellite" natural gas compressor station near Stanton, Ky, a permanent part of its facilities. The unit is a 3500-hp 4-cycle turbocharged, vertical gas engine, driving a centrifugal compressor through a speed increaser. The station is controlled by personnel at a station 80 miles away.

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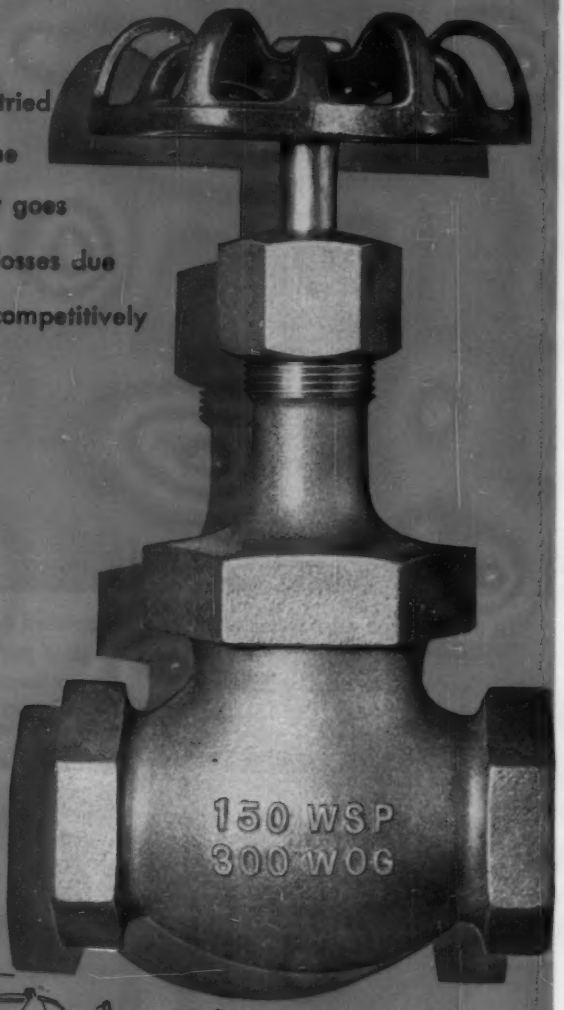

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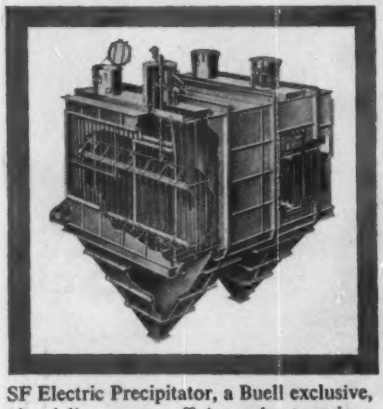
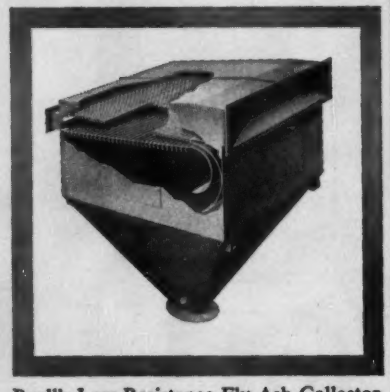
In any cyclone dust collector there is an upward eddy preventing the separation and dropping-out of a percentage of particles. But in Buell Cyclones, the exclusive Buell shave-off design *harnesses* this up-flow—puts it to work! Result: extra efficiency without extra operating cost!



SF Electric Precipitator, a Buell exclusive, also delivers *extra efficiency* due to unique Spiralectrodes and continuous cycle rapping.



Buell's Low Resistance Fly Ash Collector combines top efficiency with low draft loss, for either natural or forced draft installations.

For the complete story behind Buell's *extra efficiency*, write Dept 50-J, Buell Engineering Company, 70 Pine Street, New York 5, N. Y.

buell®

MECHANICAL ELECTRICAL

Experts at delivering Extra Efficiency in

DUST COLLECTION SYSTEMS

More FREE LITERATURE

Begins on page 165

10 **Compressor troubles,** in water- and air-cooled units, are diagnosed in bulletin PC-509 P. Cartoon sequence describes troubles, from failure to deliver air to excessive oil consumption, and helps in their location and correction. Worthington Corp, Harrison, N. J.

CONTROLS, ELECTRICAL & MECHANICAL

11 **Packaged control** for industry is subject of bulletin GEA-6334. Illustrated 12-p bulletin gives application information; lists control panel benefits in engineering assistance, design, installation and maintenance. General Electric Co, Schenectady 5, N. Y.

12 **Excitation system** is subject of 8-p illustrated bulletin 5.08. Contains description of system, practical application. Electric Regulator Corp, Pearl St, Norwalk, Conn.

13 **Instrument** and control panels and their accessory equipment are illustrated and described in 16-p bulletin G71-7. Discusses six standard designs. Bailey Meter Co, 1050 Ivanhoe Road, Cleveland 10, Ohio.

14 **Controller,** pneumatic level, is described in 32-p bulletin F-4. Describes operating principle of displacement-type float and illustrates construction available for many uses. Fisher Governor Co, Marshalltown, Iowa.

15 **Cooling controls,** self powered, for compressors, stills, solvent coolers, degreasers, oil coolers, small engines, condensers, etc are described in bulletin 710B. Includes operational drawing and hook-up sketches. Sarco Co, Inc, Empire State Bldg, New York 1, N. Y.

16 **Vibration isolation** efficiency curve is contained in 4-p bulletin 901. Booklet acts as a guide to selection of flexible mounting systems for equipment where noise and vibration control is desirable. Lord Mfg Co, 1635 W 12th St, Erie, Pa.

ELECTRICAL EQUIPMENT

17 **Explosion-proof motors** are described in bulletin 51B7286G, in NEMA rerated ratings of ½ to 30 hp (Type GZZ) and in non-rerated ratings of ½ to 100 hp (Type APZZ). Open drip-proof motors are described in bulletin 51B6210G, in NEMA rerated ratings of ½ to 40 hp (Type G) and in non-rerated ratings of ½ to 100 hp (Types AP and APWW). Totally-enclosed fan-cooled motors are described, in bulletin 51B7225D, in NEMA rerated ratings of ½ to 30 hp (Type GZ) and in non-rerated ratings of ½ to 100 hp (Type APZ). All three bulletins include

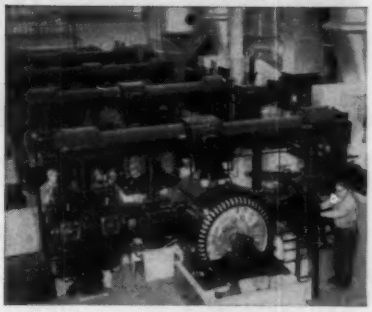
How Ford beat the construction *squeeze* at Mahwah

Steam and air flow from this boiler compressor building to meet production demands of Ford Motor Company's largest automobile assembly plant at Mahwah, N.J. Completed in 13 months, a safe margin ahead of the main assembly plant, it is a good example of how Dravo's "complete package" construction service can work for you.

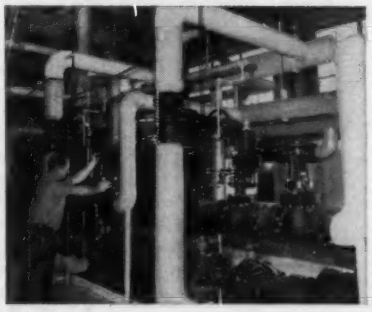
When Ford engineers planned the construction of their mammoth new automobile assembly facility, they decided to minimize delay in putting the multi-million dollar plant in production by taking full advantage of outside construction services. Dravo's power plant construction specialists were called upon to handle the construction-engineering and construction of the boiler-compressor house. Working as a team, Ford specified the steam and air needed and left the construction planning and erection of the facility up to Dravo.

As a result of this teamwork, all material and equipment was on order within a month, field construction work started in three months and initial boiler operation in 13 months. But in addition to this saving in time, costs were also cut through the use of basementless construction and many other construction innovations. The complete plant contains three 132,000 lb/hr boilers and four 2400 cfm air compressors—all conveniently arranged on one operating level with centralized control.

You, too, can profit through Dravo's single-contract responsibility, ranging over all types of jobs from power plant erection to the installation of a pump. Write for Bulletin No. 1300.



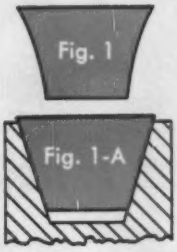
Four air compressors installed by Dravo supply the Ford assembly plant with 9,600 cu ft of air per minute.



Power piping for the boilers at Ford's Mahwah assembly plant was fabricated at Dravo's Marietta, Ohio, plant for erection on the site.

DRAVO
CORPORATION
Fifth and Liberty Avenues, Pittsburgh 22, Pa.

Why you get more service from V-Belts with CONCAVE SIDES



Each sidewall of a Gates V-belt is concave (Fig. 1)—a precisely engineered curve that makes V-belts last far longer.

HERE'S WHY: on the bend around the sheave, the concave sides of a Gates V-belt fill out and become straight (Fig. 1-A). Thus the belt makes full contact with the sides of the sheave, grips the sheave *evenly*. This even contact distributes wear uniformly across the sides of the belt.

Uniform wear lengthens belt life; keeps costs down.

MAKE THIS SIMPLE TEST

Bend a straight-sided belt (Fig. 2). The sides bulge at the bend causing uneven contact in the pulley groove (Fig. 2-A). Naturally, wear is greater at points indicated by arrows. Result: shorter belt life, increased belt costs.

To cut down-time and V-belt replacement costs, specify belts that grip evenly and wear longer. Specify Gates Vulco Rope—the V-belt with concave sides. There is a Gates distributor nearby who will quickly supply the belts you need. The Gates Rubber Co., Denver, Colorado—*World's Largest Maker of V-Belts.*

There are Gates Engineering Offices and Distributor Stocks in all industrial centers of the United States and Canada, and in 70 other countries throughout the world.

TPA 109

Gates

Gates VULCO ROPE Drives

More FREE LITERATURE

Begins on page 165

cut-away views, tables of ratings, dimensions and a hp frame chart. Allis-Chalmers Mfg Co, 952 S 70th St, Milwaukee, Wis.

18 **Electrical distribution** systems, underfloor, are described in 8-p illustrated bulletin No. 756. Bulletin announces large-capacity duct for use in standard company systems. Walker Bros, End and Hector Sts, Conshohocken, Pa.

19 **Load center transformers** are subject of 12-p bulletin CS-1000. Contains engineering data, weights and dimensions. Covers construction features on liquid-filled and dry-type units for either inoor or outdoor installation with illustrations and drawings of typical applications.. Kuhlman Electric Co, Bay City, Mich.

20 **Flexible copper braid.** Electrical and physical properties are reported in 13-p illustrated bulletin 27. Illustrated by curves, tables, diagrams, and photos; contains summary of findings by engineers who have been testing flexible braid under varied operating conditions. Burndy Engineering Co, Inc, Norwalk, Conn.

HEAT EXCHANGERS, CONDENSERS

21 **Desuperheater** is described in 4-p illustrated bulletin 1024. Describes capabilities and specs of steam-assist type of desuperheater. Copes-Vulcan Div, Blaw-Knox Co, Erie 4, Pa.

22 **Storage water heaters** are subject of revised catalog 19. Tab indexed, 48-p bulletin contains latest provisions of 1952 ASME Code for unfired pressure vessels (U-69). Selection of tables of capacities and weights, dimensions, hot-water fixture capacities, material thicknesses, heating elements and construction details are offered, in addition to piping diagrams and installation suggestions. The Paterson-Kelley Co, Inc, 501 Fulton St, East Stroudsburg, Pa.

MAINTENANCE EQUIPMENT & MATERIALS

23 **Counterpoise pipe hangers** are described in 16-p illustrated bulletin 156. Gives complete specs, engineering drawings of all models, weight-load selection tables. National Valve and Mfg Co, 3100 Liberty Ave, Pittsburgh 1, Pa.

24 **Leather packings,** their design and application, are discussed in 60-p illustrated bulletin. Lists recommended dimensional standards for various types of mechanical leather packings. Book was compiled with users and designers of hydraulic and pneumatic equipment in mind. Mechanical Leather Packing Div, National Industrial Leather Assn, 320 Broadway, New York 7, N.Y. (*Continued on page* 228)

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LimiTorque® *Automatic* VALVE OPERATION?

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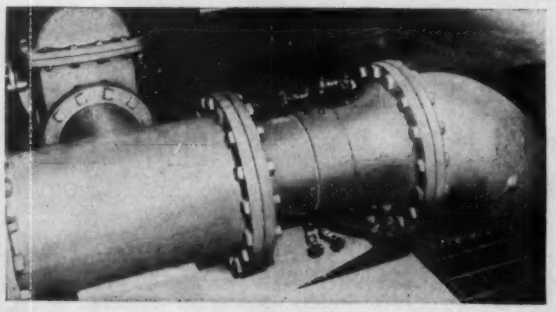
LOW INSTALLATION COST—Gentile Flow Tubes can be installed with no straight run upstream or downstream, except where near valves or regulators.



Actual installation of a 16" Flow Tube for REVERSE FLOW. Note fittings (elbow and tee) are bolted directly to flanges of Flow Tube.

Gentile Flow Tubes can be furnished with or without suitable secondary indicating, recording, or totalizing instruments.

GENTILE Flow tubes are manufactured exclusively by Foster Engineering Company

Write for further information or specific recommendations.

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AUTOMATIC VALVES • CONTROL VALVES • SAFETY VALVES • FLOW TUBES

More FREE LITERATURE

Begins on page 165

25 **Tube expanders** and associated tools used for tube rolling are discussed in detail in 119-p illustrated bulletin 88. Includes special sections devoted to expanders, general accessories, measuring instruments, rollers, extensions and drives. Includes new tools and methods in addition to information on standard equipment. Thomas C Wilson, Inc, 21-11 44th Ave, Long Island City 1, New York.

26 **Protective paint** is subject of 30-p bulletin 760. Includes painting data in form of charts, tables, diagrams and illustrations. Complete line of paints and related primers are presented along with surface preparation, priming, application methods and maintenance instructions. Plastics and Synthetics Div, The U.S. Stoneware Co, Akron 9, Ohio.

MECHANICAL TRANSMISSION

27 **Flexible couplings** are described in 4-p bulletin 203. Illustrations include flexible coupling applications on a cutter grinder, generator drive, propulsion drive, window lift and food blender. Lord Mfg Co, 1635 W 12th St, Erie, Pa.

28 **Torque converters.** Heavy-duty single-stage hydraulic units, for transmission of 100 to 1000 hp to industrial machinery are discussed in bulletin 468. Gives features and specs of 17 sizes and capacities of converters for exact matching with engines in this power range. The National Supply Co, Two Gateway Center, Pittsburgh, Pa.

29 **Coupling selection chart,** 22x17 in., reduces time necessary to select a flexible coupling to a matter of minutes. Morse Chain Co, Ithaca, N. Y.

30 **Torque converter,** single stage, *1500 Series,* is described in 4-p illustrated bulletin 508. Illustrations and tables on single-stage converter fluid circuit, hp and rpm capacity, and specs are included. Twin Disc Clutch Co, Rockford, Ill.

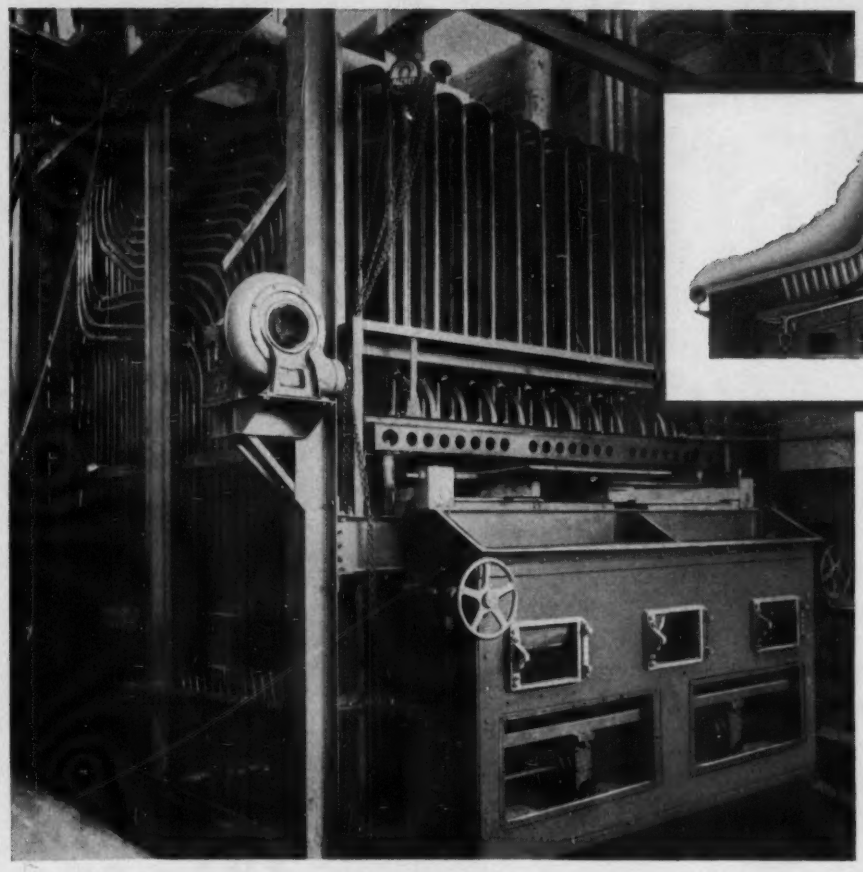
31 **Fluid drives,** 1 through 25 hp *Type VS* Class 2, are described in 8-p illustrated bulletin 9819. Includes selection tables, design and general construction features. American Blower Corp, Detroit 32, Mich.

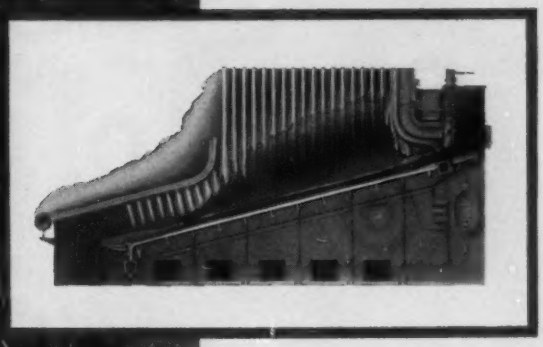
METERS AND INSTRUMENTS

32 **Recording,** indicating and controlling instruments required in industrial processing are subject of 4-p bulletin F-403. Fielden Instrument Div, Robertshaw-Fulton Controls Co, 2920 N 4th St, Philadelphia 33, Pa.

33 **Measuring,** transmitting, receiving, recording, indicating instruments and control components for power and process applications are

NOW! TWO MORE VIBRA-GRATES ORDERED





Fuel on the Vibra-Grate stoker is moved by an intermittent vibrating motion of the grate. Water cooling of grates insures positive fuel bed movement.

Vibra-Grates burn a wide variety of coals with top efficiency. Stokers of this design have been in service abroad since 1947. Nearly 100 units are in operation or being built in Europe, the Middle East and the U. S.

◀ Vibra-Grates like this installed in the United States have proved extremely reliable.

WHEN A SOUTHERN STATE required a new stoker installation at one of its institutions, it set up certain basic requirements... great reliability ...abolition of smoke... freedom from objectionable discharge of solids from stack, all while burning local coals. Freedom from fly ash discharge was so essential, in fact, that any form of suspension or semi-suspension burning of coal was eliminated from consideration. AE water-cooled Vibra-Grate stokers were the obvious answer and two of them will be installed... *without dust collectors.*

Each Vibra-Grate stoker will have a steam generating capacity of 30,000# per hour continuously, with 35,000# peaks. The coal to be burned has the following proximate analysis: H_2O, 3%; V.M., 18%; F.C. 67%; ash, 12%; S., 1.5%; BTU per # A.F., 13,400. Other Vibra-Grates in the United States have been burning high volatile coals.

AE Vibra-Grate stokers are available in standard capacity ranges from 25,000 to 150,000# of steam per hour. Write for full information about Vibra-Grate, today's most efficient stoker.

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More FREE LITERATURE

Begins on page 165

described in 8-p illustrated bulletin G 15-1. Includes literature references for each of the 100 products listed. Bailey Meter Co, 1050 Ivanhoe Rd, Cleveland 10, Ohio.

34 **Flow-rater meters,** multi-stage variable-area, are subject of illustrated 6-p bulletin 10-A-34. Fischer & Porter Co, 778 Jacksonville Rd, Hatboro, Pa.

35 **Liquid-level gages,** remote reading, are described in 8-p illustrated catalog 291. Covers gages in four pressure groups from under 900 psi to over 1500 psi. Jerguson Gage & Valve Co, 80 Fellsway, Somerville 45, Mass.

PIPING, VALVES, FITTINGS

36 **Automatic pressure,** temperature and level control valves for automatic process control are subject of 8-p bulletin 56C. Atlas Valve Co, 280 S St, Newark 5, N. J.

37 **Thermostatic control** valves are described in illustrated, 8-p catalog C-7. Contains descriptions, engineering data on firm's line of shower mixing valves, steam temperature regulators, water controllers, tempering valves and other products. Lawler Automatic Controls, Inc, Mount Vernon, N. Y.

38 **Bronze** globe valves, *LQ600,* are subject of 4-p circular 602-2. Contains information on two pressure classes for a wide variety of services from normal to exceptionally severe. Lunkenheimer Co, Box 360, Cincinnati 14, Ohio.

39 **Welding fittings,** in carbon, alloy and stainless steel, and forged-steel flanges are described in 6-p illustrated bulletin FB-502. Tubular Products Div, The Babcock & Wilcox Co, Beaver Falls, Pa.

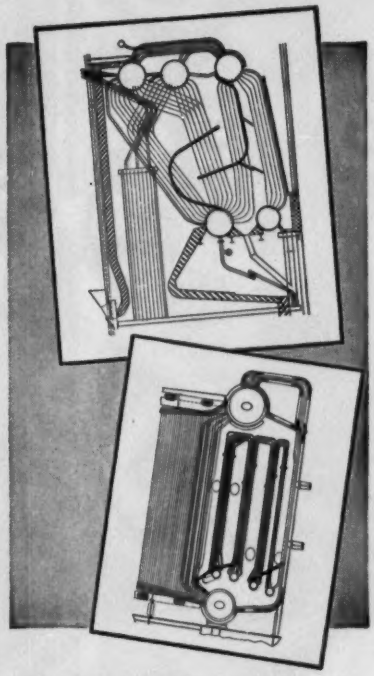
MISCELLANEOUS

★ **Engineering data** wall chart gives tables on decimal equivalents, temperature conversion, wire size and current ratings, mechanical and electrical conversion tables. ★Request direct, on company letterhead, from Perkin Engineering Corp, 345 Kansas St, El Segundo, Calif.

★ **Electrical safety rules,** for children, are brought out in story form in 32-p illustrated book titled *The Adventures of Grandpa Champ.* ★Request direct from Aircraft-Marine Products, Inc, 2100 Paxton St, Harrisburg, Pa.

40 **Control equipment** for power plants is described in 12-p illustrated bulletin 1022-A. Reviews combustion and boiler feedwater control, pressure reducing, desuperheating and automatic soot blowing, including retractable and rotary soot blowers. Copes-Vulcan Div, Blaw-Knox Co, Erie 4, Pa

ONLY ENCO BAFFLES *give you all these* **COST CUTTING FEATURES**



These important fuel-saving maintenance-reducing features are obtainable with Enco boiler baffles—*and only with Enco baffles.*

- **Streamlined gas flow**
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. . . with *union* body-bonnet joint on 125 lb., 150 lb., 200 lb. pressure classes

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The separate union nut seals the bonnet and body mating surfaces, effecting a tight, leak-proof joint. Possibility of distorting body and bonnet during disassembly and assembly and of loosening the joint during operation are virtually eliminated.

OIC design reduces maintenance costs

Necessity for stem replacement can be forgotten, because stems are special, long-lived OIC *Alloy-40*. This sturdy material eliminates galling and seizing and contributes to easy operation.

Stem threads are never exposed to line fluids in open or closed positions (125 lb. and 150 lb.), preventing thread abrasion from line fluids or suspended solids.

All pressure parts are designed for maximum strength, and working parts are hydrostatically tested for positive sealing and seating. Write for our folder, No. 1006. ***Order from your OIC distributor.***

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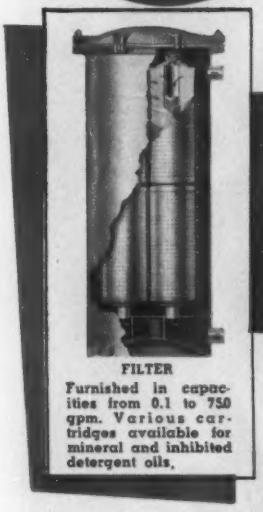

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HILCO Purification Means *Complete* Oil Purification . . .

You get absolute removal of sludge, acids, carbon, water and fuel dilution with a properly selected HILCO. Clean oil saves you money. Expensive maintenance is reduced, equipment shut-downs practically eliminated, lost man hours and cuts in production become a thing of the past. HILCO continuous, all electric, automatic purification keeps your oil clean and in top condition at all times. You receive the full capacity and economy of your equipment.

HILCO offers a wide range of oil purification units to meet every oil conditioning problem. HILCO units are manufactured in both stationary and portable models. Write us about your purification needs . . . recommendations are given with no obligation. Let HILCO put its 25 years of experience in oil purification to work for you.

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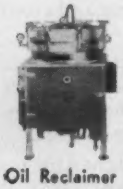
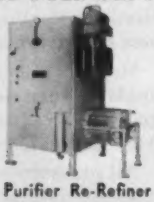


Oil Reclaimer



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REPORTS from the FIELD

Begins on page 150

manufacture of large liquid-propellent engines.

In the atomic section, visitors will see a scale model of the first nuclear reactor to be built in the Far East. This represents a 50-kw solution-type research reactor to be constructed for the Atomic Energy Research Institute of Japan, near Tokyo, next year.

To help solve the day-to-day problems of power engineers, other exhibits range from packaged boilers to the complex of separate units that are integrated into the massive concept of the generating station.

Typical exhibits include drop-forged steel valves, a representative line comprised of nearly all types of power transmission products, a line of special-purpose lubricants and another of long-life lubrication products.

For those interested in electrical apparatus, a comprehensive array will be on view. The long life expectancy, high efficiency and inherent voltage stability of a germanium dc power supply system, said to be (plus/minus) 1 volt from no load to full load, will be noted. There will also be a line of in-between sizes of magnetic controls, permitting starter and motor to be matched; as well as "one coil that takes the place of six,"—a dual-voltage coil that is moisture and fungus proof, non-combustible and impervious to puncture. There will be, in addition, a reversing motor that sets new standards for rapidly reversing loads of machine tools.

As in previous years, the four-day exposition will be open to visitors by invitation and registration only. The general public will not be admitted.

A.G.E. chooses Wabash as site of world's largest generator

► THE WORLD'S LARGEST GENERATOR will be built on the banks of the Wabash at Sullivan, Indiana. The announcement came from officials of the American Gas and Electric Co.

The Indiana and Michigan Electric Co, an A.G.E. operating subsidiary, will build a $58,000,000 power plant about the 450,000 kilowatt unit which is scheduled to be on line late in 1958.

The Ayrshire Collieries Corp will supply 1,300,000 tons of coal a year from a new mine which it will develop nearby.

The power plant site is about 100 miles from the nearest A.G.E. service area and will be linked to the system by a 330,000-volt transmission line.

A second 450,000 kw unit has been ordered from the General Electric Co,

FLEXIBLE TUBING
for the
POWER INDUSTRY

On air intakes, fuel lines, exhaust lines, Penflex Flexible Tubing has proved itself in power plants across the nation. Rugged . . . tough . . . flexible Penflex Tubing is made to stand the most severe usage.

From 1/8" to 24" I.D. . . . bronze, galvanized or stainless steel Penflex makes all types and sizes of flexible metal tubing. Penflex "Flexineering"—the science of applying flexible tubing to fit the particular needs of the power plants—assures the right tubing on each installation.

When you require metal tubing that is tight as a pipe, but flexible . . . safe at high temperatures . . . and free from metal fatigue specify Penflex. Write for your copy of "Flexineering" today.

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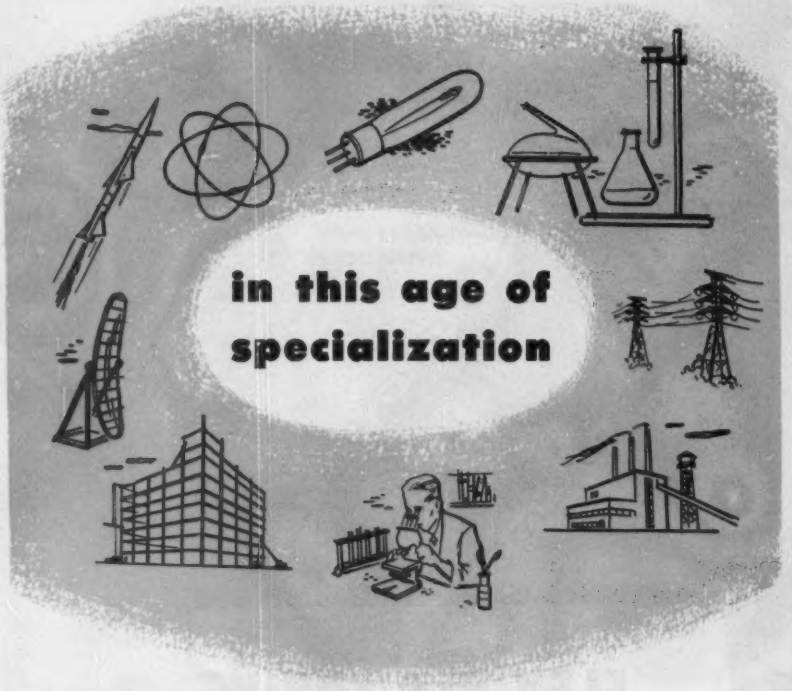
PENFLEX

HEART OF INDUSTRY'S LIFELINES



Get a Specialist . . .
get LACLEDE!

Due to the great advances in technical knowledge, specialization has become absolutely necessary.

For over fifty years Laclede Stoker Company has specialized in the manufacture of stokers . . . and only stokers. All our experience, our engineering talent, and our research have been used to build a better stoker.

Laclede stokers have been efficiently operating for years, in hundreds of installations, firing boilers made by practically every well known boiler manufacturer. For any boiler, regardless of make, Laclede engineers will provide a stoker with guaranteed performance, low in initial, operating and maintenance costs, and burn bituminous coal most efficiently.

When YOU need a stoker, get one that is built by a STOKER SPECIALIST . . .

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STOKER COMPANY
4440 HUNT AVE. • ST. LOUIS 10, MO.

REPORTS from the FIELD

Begins on page 150

but as yet a site for this unit has not been chosen. Each of the two units will be 73 percent larger than any unit operating today.

The plant itself is expected to be 5 percent more efficient in converting heat into electricity than any generator heretofore. While having twice the capability of the largest unit now under construction in A.G.E.'s seven-state system, the new unit will occupy only one-third more space.

The Babcock & Wilcox Co will build the boiler. It will be as tall as a twenty-three-story building and will require a stack about 500 ft tall.

Calendar of Events

Oct 8-10—American Society of Mechanical Engineers and **American Society of Lubrication Engineers,** 3rd jointly-sponsored Lubrication Conference. Chalfonte-Haddon Hall, Atlantic City, N. J. Complete details from ASME, 29 W 39th St, New York 18, N. Y. or from ASLE, 84 E Randolph St, Chicago, Ill.

Oct 8-12 — American Society for Metals, 38th Annual National Metal Congress and Exposition. Public Auditorium and Exhibition Hall, Cleveland. Full information from ASM, 7301 Euclid Ave, Cleveland 3, Ohio.

Oct 9-10—Industrial Coal Conference, co-sponsored by Indiana Coal Association and Purdue University. Details from James B Ball, Purdue University, Division of Adult Education, Lafayette, Ind.

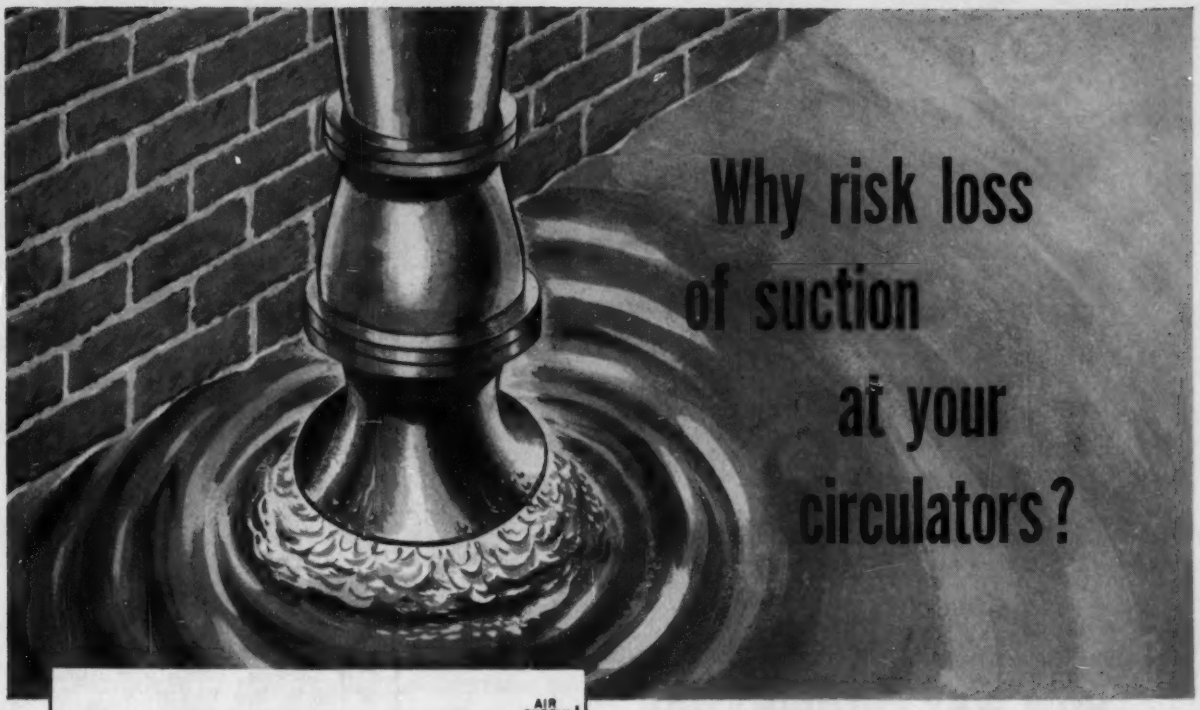
Oct 15-17—National Association of Corrosion Engineers, meeting of Northeast region. Drake Hotel, Philadelphia. Details from NACE, 1061 M & M Bldg, Houston 2, Texas.

Oct 18-19—12th annual National Conference on Industrial Hydraulics, Hotel Sherman, Chicago. Details from Illinois Institute of Technology, 35 W 33rd St, Technology Center, Chicago 16, Ill.

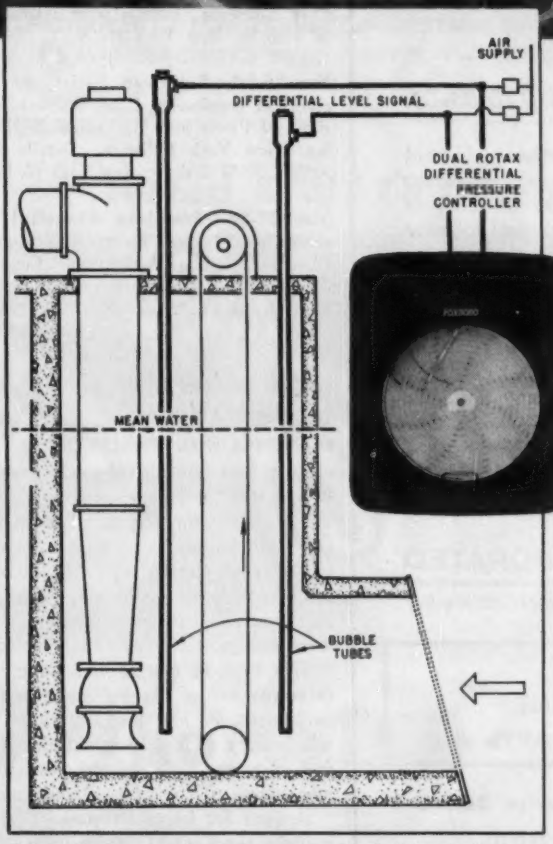
Oct 22-26—National Safety Council, 44th National Safety Congress and Exposition, Conrad Hilton, Congress, Morrison and LaSalle Hotels, Chicago. Further information obtainable from NSC, 425 N Michigan Ave, Chicago 11, Ill.

Oct 23-26—National Association of Corrosion Engineers, meeting of South Central region. San Antonio, Texas. Details from NACE, 1061 M & M Bldg, Houston 2, Texas.

Oct 25-26—American Society of Mechanical Engineers and **American Institute of Mining and Metallurgical Engineers,** National Solid Fuels Confer-



Why risk loss of suction at your circulators?



Schematic diagram shows how water level differential across screen is continuously measured by bubble tubes. Rotax Controller starts and stops screen and spray motors as required.

. . . let Foxboro Control keep traveling screens clean — *automatically*

You can easily make certain that your suction well will never go dry due to a sudden pile-up of refuse on the traveling screen. Just put Foxboro Liquid Level Type Traveling Screen Control on guard.

This completely adjustable Foxboro System automatically starts the screen motor and cleansing spray whenever accumulated refuse causes water level on opposite sides of the screen to differ more than a desired, pre-set amount. And, in addition to purging the screen and restoring proper intake level, this versatile system can carry out any or all of the following "positive protection" functions — depending on plant requirements: 1. Annunciate "high" differential water level at adjustable set-points. 2. Prevent start of screen until sprays are on — to avoid carry-over. 3. Shut down screen motor and spray pump (a) when proper level is restored — or (b) when screen has made one complete rotation. 4. Indicate or record differential level in ranges from 0-5" water to 0-50" water. 5. Annunciate loss of purging air supply. 6. Provide centralization of *all* screen house functions.

Let this modern system protect your plant against costly shut-downs. It's easily installed, inexpensive to operate, thoroughly dependable. For full details, contact your nearby Foxboro Field Engineer, or write **The Foxboro Company, 6810 Neponset Ave., Foxboro, Mass.**

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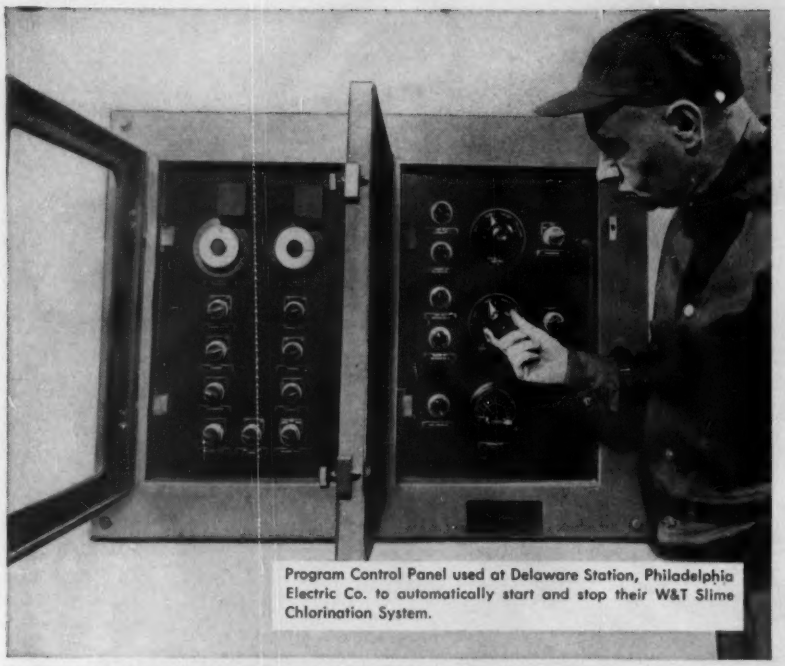
INSTRUMENTATION
FOR THE POWER INDUSTRY



Program Control Panel used at Delaware Station, Philadelphia Electric Co. to automatically start and stop their W&T Slime Chlorination System.

HOW W&T CHLORINATION

controls slime in power generating plants

The Philadelphia Electric Co. has W&T chlorination equipment installed in their steam-electric generating stations to prevent slimes from fouling the turbine condensers and lowering the efficiency of the units. Maintaining cooling efficiency saves enough fuel to more than pay for the treatment.

Chlorination is controlled from a W&T Program Control Panel like the one pictured. Operators preselect chlorine dosage and treatment times. Chlorination is started and stopped automatically in accordance with the preselected schedule. The result is positive slime control without requiring personnel to supervise each treatment and without the expense of chlorinating continuously.

For information about W&T Slime Control Systems write for Bulletin CD-42.

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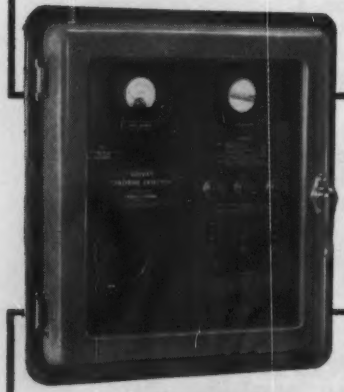

HOW TO DETECT 3 PARTS CHLORINE IN A MILLION PARTS AIR

New W&T Solvay Chlorine Detector*

detects as little as 3 p.p.m. chlorine in a continuous air-stream sample. Automatically sets off alarm at higher concentrations.

Write for Publication 50.118

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I-55 *Manufactured under patent license from Solvay Process Div., Allied Chemical & Dye Corp.

REPORTS from the FIELD

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ence. Sheraton Park Hotel, Washington, D.C. Details from ASME, 29 W 39th St, New York 18, N. Y.

Oct 31-Nov 2—Society for Experimental Stress Analysis, 1956 Annual Meeting and Exhibit. Deshler-Hilton Hotel, Columbus, Ohio. For details write to SESA, Box 168, Cambridge 39, Mass.

Oct 31-Nov 2 — Industrial Management Society, 20th Anniversary National Time and Motion Study and Management Clinic. Sherman Hotel, Chicago. Details from IMS, 35 E Wacker Dr, Chicago 1, Ill.

Nov 8-9—National Association of Corrosion Engineers, meeting of Southeast region. Charlotte, N. C. Details from NACE, 1061 M & M Bldg, Houston 2, Texas.

Nov 12-16—1st annual National Industrial Development Exposition, New York Coliseum. Details from NIDE, 356 W 58th St, New York 19, N. Y.

Nov 26-30—American Society of Mechanical Engineers, 22nd National Exposition of Power and Mechanical Engineering. New York Coliseum. Details from ASME, 29 W 39th St, New York 18, N. Y.

Nov 27-30—American Chemical Society, 9th National Chemical Exposition. Cleveland Public Auditorium. Complete details available from NCE, 86 E Randolph St, Chicago 1, Ill.

British nuclear power plant to generate electricity

► BRITONS WILL WITNESS the opening of their first commercial nuclear power station this October when Queen Elizabeth cuts the tape on the door of Calder Hall Station.

The new station will be the first concrete step in a four-stage plan for the generation of electricity from nuclear energy.

This first, or commercial stage, features the use of big stations suited to continuous, or base-load, operation. It will fulfill a vital need in Britain where fuel costs are high and the need for a new source of energy is already acute.

Designs for improved stations, to be built by the Central Electricity Authority, will be based on the Calder Hall Station. The sites for two of these have been chosen, and proposals for a third station, in Scotland, have been examined.

The three subsequent stages of the plan have been outlined in a report by A W Haslett, Editor-in-Charge of the Times Science Review.

In the second stage, according to

Vapor Steam Generators
Standard of Quality in the Railroad Field
Standardize on Babcock & Wilcox ERW Tubing

Exhaustive tests by Vapor engineers have proved the advantages to railroads of B&W ERW tubing—for unvarying uniform thickness, corrosion-resistance and long, trouble-free tube life. B&W welded tubing is precision manufactured from selected, scale-free strip steel of uniform thickness and of proper A.S.M.E. designated specifications. That's why B&W ERW tubing is standard with Vapor—for its full line of Steam Generators, for both new and replacement use.

SELECTED BY VAPOR HEATING CORPORATION, WORLD'S LARGEST PRODUCER OF COIL TYPE PACKAGE STEAM GENERATORS, BECAUSE IT'S MANUFACTURED WITH PRECISION—TESTED FOR UNIFORMITY

tested 8 WAYS for performance in service

Hydrostatic test and visual inspection

Chemical checks

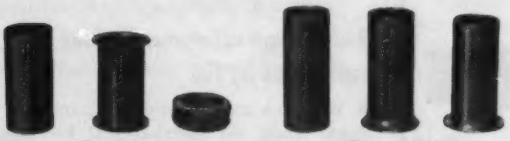
Tensile test

Hardness test

Frequent periodic testing and inspection of every tube assures consistent high quality and uniformity. Each B&W Electric Resistance-Welded Pressure Tube is subjected to the hydrostatic test. Hardness and chemical tests are made to specifications. Flanging, flattening and reverse flattening tests assure weld quality control. Micrometric inspection provides positive uniformity of outside diameter and wall thickness. That's why B&W ERW tubing has achieved acceptance for so many diversified pressure applications, including approval under U. S. Navy Specification MIL 17188. The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pa.

Reverse flattening test

Flattening test

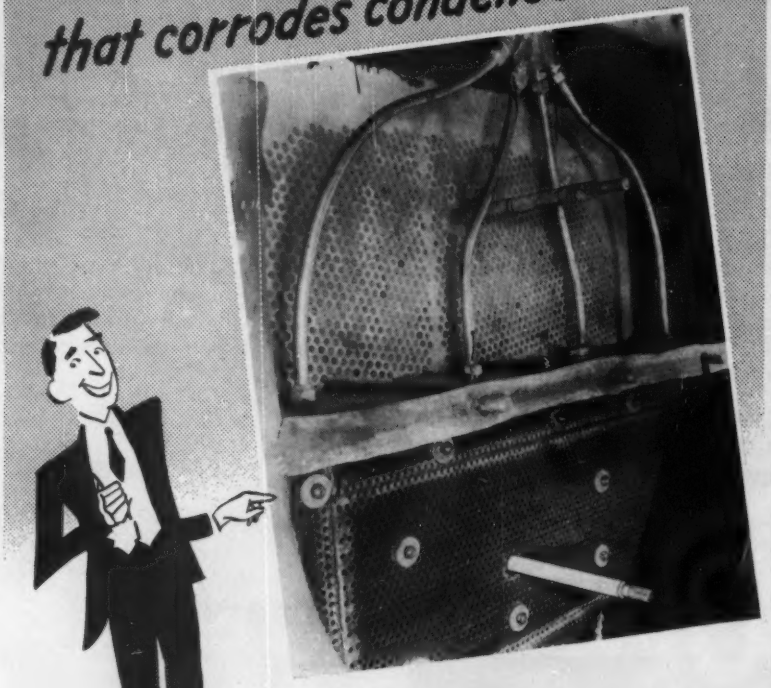


Crush test Flange test

TA-6072(G)

Seamless and welded tubular products, seamless welding fittings and flanges—in carbon, alloy and stainless steels

This traps AIR that corrodes condenser tubes



IT'S THE CONSECO AIR CORROSION ELIMINATOR

Air is the "Senior Delinquent" in the entire condenser-tube-corrosion family. Water turbulence liberates air in tubes. Air attacks tube surfaces, causes inlet tube end corrosion eventually necessitating retubing. But the Conseco Air Corrosion Eliminator separates air from water BEFORE water enters tubes. These Air Corrosion Eliminators are fitted in condensers having 1, 2 or more passes.

If impractical to install Air Corrosion Eliminators, the next best thing is to insert Conseco FLOWRITES in the inlet ends of tubes. Millions of FLOWRITES are in use, in every type of heat exchangers, all over the world. If you want us to do the job for you, just call our Service Department.

Send for Bulletins giving complete engineering data on these products.

EQUIPMENT DESIGNED AND BUILT BY CONSECO

HEAT EXCHANGERS • CONDENSERS • EVAPORATORS • STEAM JET AIR EJECTORS • STEAM GENERATORS • PRESSURE VESSELS CENTRIFUGES • FILTERS • STRAINERS • INSTRUMENTS, SPECIALTIES

14

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Designers and Builders of Equipment for Power, Refining, Chemical and Marine Industries

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HOBOKEN, N. J.

REPORTS from the FIELD

Begins on page 150

Mr Haslett, nuclear energy will become commercial in countries which, like Britain, are highly industrialized, but which are better provided with cheap energy. Design will be technically more advanced, the conversion of raw nuclear fuel into energy will proceed more rapidly, and costs will be less. The choice of a second-stage type of station is expected to be made about the end of the year, and a prototype to be built by 1960. If satisfactory economically, production stations developed from this type might then be built during the 1960's.

In the third stage, it is expected that expansion will again be more rapid, both in Britain and on a world scale. Types of nuclear stations will then be in use which produce more nuclear fuel than they consume. It is predicted that there will be more flexibility in size of station and many more countries will be buying power stations.

In the fourth stage, which is still remote, the energy of the hydrogen bomb may have been tamed, Mr Haslett says, and the problem of energy sources solved for so long a time ahead that no foreseeable limit could be set.

Third Steel Founder's contest open now; closes June 1957

► NATIONAL PRIZES of $1000, $750, $400, $200 and $100 are being offered in each of two classes in the third Product Development Contest of the Steel Founders' Society of America. Class I includes all persons not employed by the steel castings industry and Class II covers its employees. The contest closes midnight June 1, 1957. Staff members of the Society are not eligible. Contest is conducted every third year by the SFSA Product and Market Development Committee.

Gold, silver, bronze, blue and steel-gray certificates are being offered on a national basis, in addition to the prizes, for each of the classes in a list of subjects which cover industrial business practices, engineering and operations.

Complete information about the contest is available upon request from the Product and Market Development Committee of the SFSA, 606 Terminal Tower Building, Cleveland 13, Ohio.

3 aluminum recommendations authorized by IEC

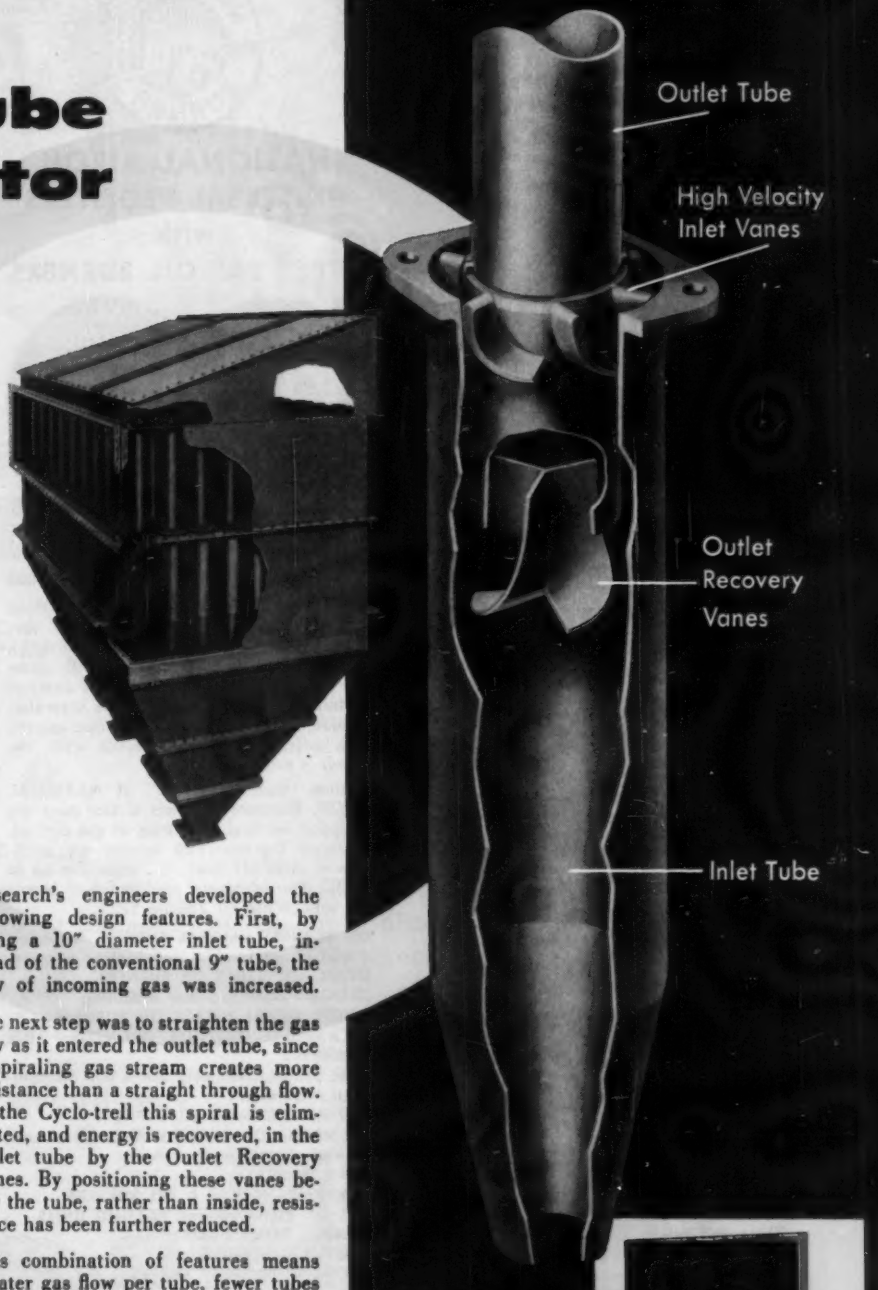
► WITH AN EYE to promoting international trade, the International Electrotechnical Commission, the world's standardizing body in the electrical

NEW Cyclo-trell

multiple tube dust collector

Here are a few brief facts on Research's new multiple tube mechanical collector.

- Collection efficiencies are higher, for a given pressure drop, than other conventional multiple tube collectors.
- Gas flow per tube is higher than conventional units. This means fewer tubes per collector and lower total cost for a given capacity.
- Cyclo-trell's design is based on Research's 45 years experience in manufacturing gas cleaning equipment. As the largest manufacturer of electrical precipitators in the world, Research-Cottrell has engineered and built many combination units consisting of precipitators and mechanical collectors.



Higher Collection Efficiency

An important reason for Cyclo-trell's higher collection efficiency is the aerodynamically shaped inlet vane unit. The purpose of these vanes is to produce a fast spiral of incoming gas. The faster these gases spin, the greater the centrifugal force on the suspended dust.

After testing many types and curvatures of vanes, Research found that this new design resulted in less turbulence, greater centrifugal force and higher collection efficiencies.

Greater Gas Handling Capacity

To develop a higher gas flow capacity than other multiple tube collectors, Research's engineers developed the following design features. First, by using a 10" diameter inlet tube, instead of the conventional 9" tube, the flow of incoming gas was increased.

The next step was to straighten the gas flow as it entered the outlet tube, since a spiraling gas stream creates more resistance than a straight through flow. In the Cyclo-trell this spiral is eliminated, and energy is recovered, in the outlet tube by the Outlet Recovery Vanes. By positioning these vanes below the tube, rather than inside, resistance has been further reduced.

This combination of features means greater gas flow per tube, fewer tubes per collector and a lower total cost for a given capacity and efficiency.

Bulletin M gives complete details on design features, efficiency, capacity and detailed dimensional drawings. Write for your copy today.

Research-Cottrell, Inc.

Main Office and Plant: Bound Brook, N. J. • 405 Lexington Ave., New York 17, N. Y. • Grant Bldg., Pittsburgh 19, Pa. • 228 N. La Salle St., Chicago 1, Ill. • 111 Sutter Bldg., San Francisco 4, Cal.

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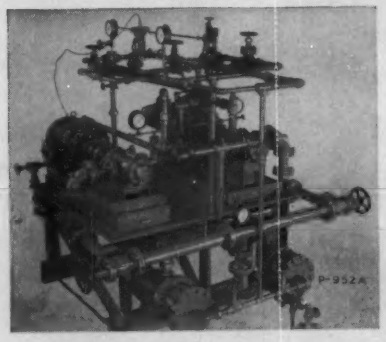

P-952A—Steam Turbine and Electric Motor drive gives flexibility in this compact Model P-ES2H size No. 25 unit.

Complete range of sizes and models in both medium and high pressure types . . . *more compact than ever!* Write for Bulletin 40.

NATIONAL AIROIL COMBUSTION ACCESSORIES

AIR CONTROL DOOR and FRAME

FUEL-OIL SUCTION STRAINER

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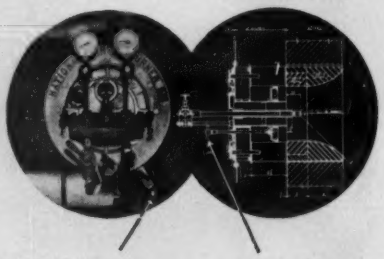
FURNACE RELIEF and ACCESS DOOR

FUEL-OIL HEATER

These and other "accessory items" for every industrial liquid fuel-gas installation. Ask for Brochure No. 10.

NATIONAL AIROIL UNIVERSAL REGISTERS with TYPE "SA" OIL BURNERS



Control for Air Vane

Control for Refractory Faced Disk

BETTER PERFORMANCE with NATIONAL AIROIL Universal Registers because they have a DUAL FEATURE for controlling air volume independent of turbulence. Air vanes can be instantly reversed to change direction of turbulence while air volume is separately regulated by a refractory faced disc control. Both adjustments can be made while the burner is firing.

Another "dual advantage" of NATIONAL AIROIL Universal Registers is that they are equipped for dual fuel firing of gas and oil. Universal Registers with burners are available in three (3) sizes . . . capacities up to 60,000 lbs. of steam produced per burner per hour. Write for Bulletin 51.

OIL BURNERS and GAS BURNERS for industrial power, process and heating purposes
STEAM ATOMIZING OIL BURNERS
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MOTOR-DRIVEN ROTARY OIL BURNERS
MECHANICAL PRESSURE ATOMIZING OIL BURNERS
DUAL STAGE, Combining Steam and Mechanical Atomization
LOW AIR PRESSURE OIL BURNERS
AUTOMATIC OIL BURNERS, for small process furnaces and heating plants
GAS BURNERS
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SPECIAL REFRACTORY SHAPES

NATIONAL AIROIL BURNER CO., INC.

1250 EAST SEDGLEY AVE., PHILADELPHIA 34, PA.

Southwestern Division: 2512 South Boulevard, Houston 6, Texas

INDUSTRIAL OIL BURNERS, GAS BURNERS, FURNACE EQUIPMENT

REPORTS from the FIELD

Begins on page 150

field, has authorized seven new recommendations for publication.

The recommendations were born at a 10-day meeting of the Commission in Munich, Germany. Seven hundred delegates, representing the electrical industry of the world, attended the meeting which concluded on July 6.

The IEC Committee on Aluminum brought before the group three draft specifications which were agreed upon and which will be published as IEC recommendations. They deal with the aluminum alloy electrical conductor wire of the Al-Si-Mg type, commercial hard drawn wire, aluminum busbars.

A new international committee, which will operate as a subcommittee of IEC Technical Committee 2 on Rotating Machinery, will deal with carbon brushes for rotating machinery. Also approved were new proposals on standard rating of 50 cycle steam turbines together with steam pressures and temperatures.

The 1957 meeting of the IEC will be held in Moscow, where delegates will be guests of U.S.S.R. National Committee of IEC from July 2-12.

To build 3 hydro stations underground in Calif.

► THE FIRST UNDERGROUND hydroelectric generating station built in the United States since 1913 will be constructed on the North Fork of Kings River, high in the California Sierra Nevada Mountains. The station is one of three which will have a capacity of 296,000,000 watts and is to be known as the Haas project.

Three of the earliest underground stations were built in the U.S. at the turn of the century. Since then, however, we have lagged behind other nations which now have 100 such installations.

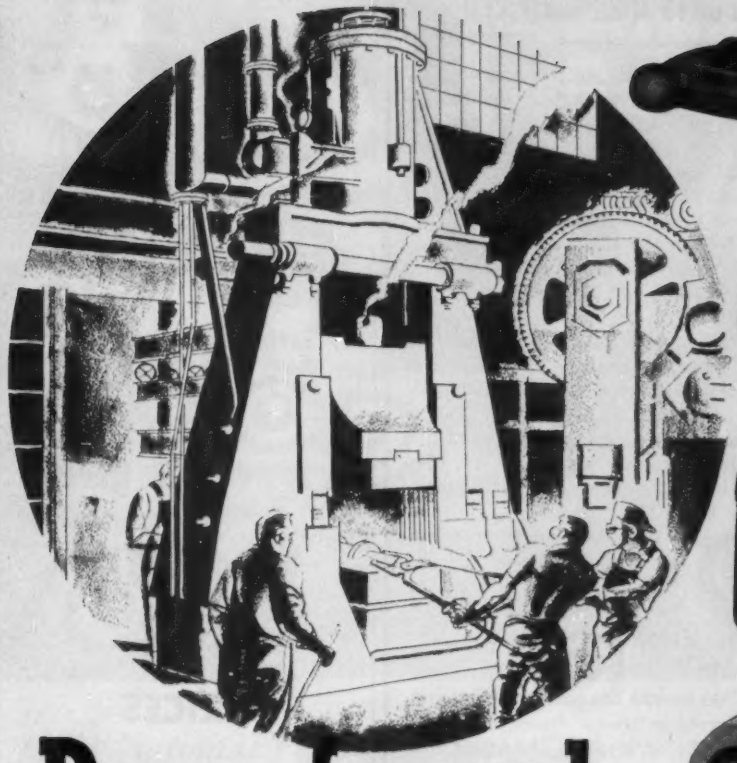
The three plants, to be completed by 1961, will include two of the highest head plants in the U.S.

The projects will include the largest vertical impulse turbines in the U.S., a head penstock crossing the river, two high rock fill dams, unlined pressure tunnels and automatic operation.

Koppers and Kennecott propose making uranium feed material

► KOPPERS CO, INC and Kennecott Copper Corp have submitted a joint proposal to the Atomic Energy Commission to produce uranium feed materials for the AEC.

The proposal, submitted Oct 1, calls for the design, construction and opera-



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Drop forging techniques, resulting from more than a half century of pioneering and development by Vogt in the production of forged steel valves, impart matchless strength and safety to the new line of Vogt GP Valves. Made from killed, clean, fine grained open hearth steel billets, forging and treatment operations result in additional grain refinement and increased toughness.

GP Valves are setting new standards of performance in petroleum refineries, chemical plants, power plants, and related industries. Available in a complete range of sizes from ¼" to 2" and rated 800 pounds at 850°F. and 2000 pounds at 100°F.

Advt. No. 4 in a series describing the features of Vogt GP Valves.

Write For Your FREE COPY of Supplement No. 1 to Catalog F-9. Address Dept. 24-FP.

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Vogt

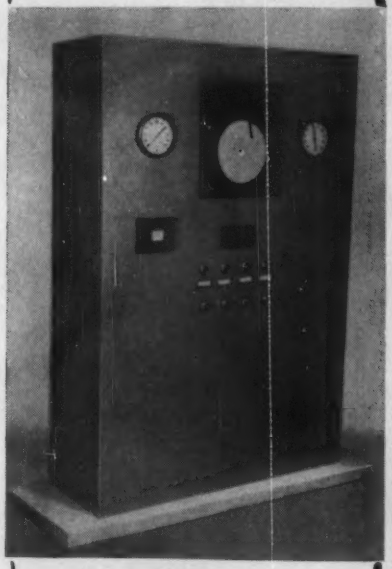
GENERAL GP PURPOSE

Vogt FOR BETTER VALVES

DROP FORGED STEEL

VALVES

CONVEY
FLY ASH
AUTOMATICALLY



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SEQUENTIAL
CONTROLS

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- Automatically controls emptying of fly ash at all points of collection
- Resets automatically
- Gives daily record of performance through recording vacuum gage
- Shows boiler position on visual indicator—at all times

WRITE TODAY FOR FULL INFORMATION

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CORPORATION
260 FORTY-SECOND STREET,
PITTSBURGH 1, PA.

REPORTS from the FIELD

Begins on page 150

tion of a feed materials processing plant with an annual productive capacity of up to 5,000 tons of uranium salts. If approved by AEC, the plant would be built with Kennecott and Koppers each furnishing 50 percent of the equity capital.

The Koppers-Kennecott proposal reflects the new policy of the Atomic Energy Act of 1955 expanding the scope of private business participation in the Atomic Energy Program. All feed materials are now being made in government owned plants, but in November of 1955 the Atomic Energy Commission announced its new policy on feed materials whereby it has been soliciting proposals from qualified private firms. The proposed Kennecott-Koppers plant would constitute a substantial part of the feed materials program.

White Motor Co generators sent to Venezuela

► TWO MOBILE GENERATORS permanently housed in tractor trailer units have left Ohio on a precedent-setting trip for South America.

The 500 kw generators are the first purchased for use in Venezuela. They were engineered and produced by the White Diesel Engine Div of the White Motor Co.

General Manager William Burrows said, "We consider this shipment a harbinger and a start. Many Latin American nations are rapidly expanding their industry. The result is a need for more electric power as fast as possible, and that includes mobile power."

Both sets will be used by the Venezuela Development Corp as replacement power for areas where power lines and systems are being re-routed and expanded.

". . . and therefore, all soot blower elements should be heated before any attempt is made to straighten them."

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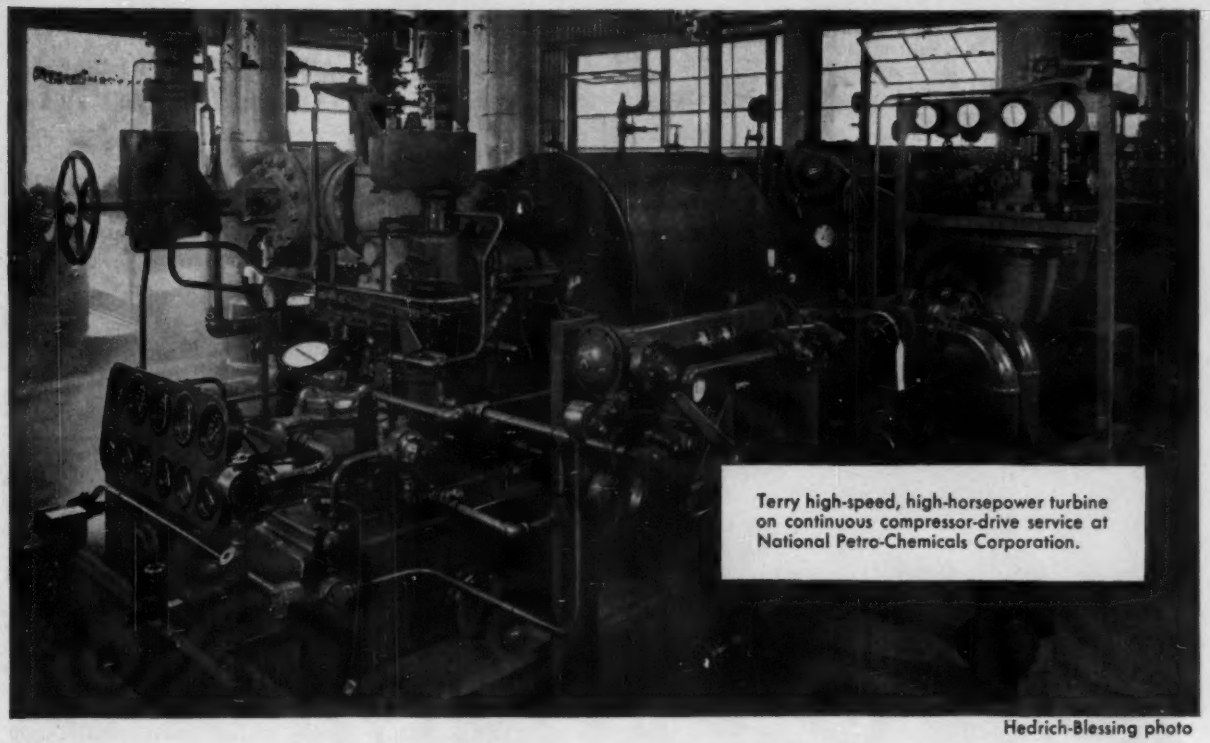
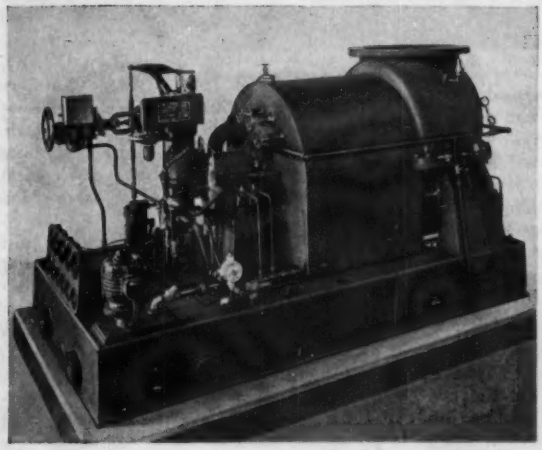


Terry high-speed, high-horsepower turbine on continuous compressor-drive service at National Petro-Chemicals Corporation.

Hedrich-Blessing photo

At National Petro-Chemicals Corporation . . .

Terry high-speed compressor-drive turbines provide continuous 'round-the-clock service



One of the two 5400 hp., 7486 rpm turbines built for the Tuscola plant of National Petro-Chemicals Corporation.

In the fall of 1953, five Terry multistage turbines were placed on day-and-night duty at the Tuscola, Illinois, Plant of National Petro-Chemicals Corporation. They drive high-speed compressors used to compress hydrocarbon gases in the production of ethylene.

The *excellent performance of these initial units later resulted in the installation of two more Terry machines.* These were placed in service some two years later.

In all, the seven turbines total more than 30,000 hp. They range in capacity from 3300 to 5400 hp., and in speed from 7500 to 9700 rpm.

The National Petro-Chemicals installation, and the thousands of other units serving in refineries and chemical plants throughout the world, are testimony to the low maintenance and consistent reliability of Terry turbines. Put Terry to work for you. Write for further information.

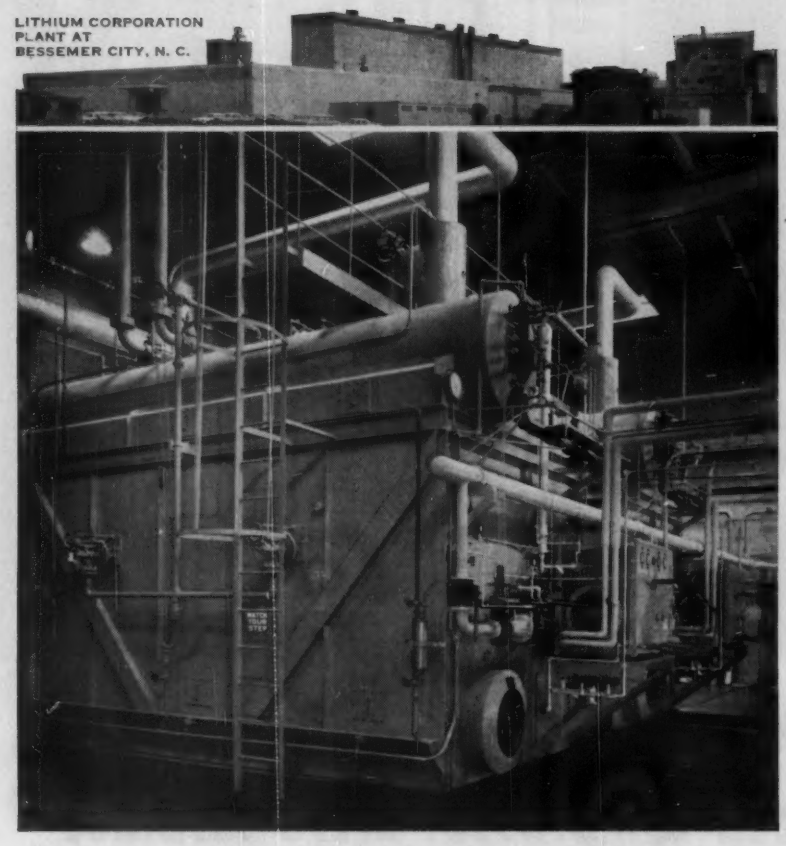
THE TERRY STEAM TURBINE CO.

TERRY SQUARE, HARTFORD 1, CONN.

TERRY

TT-1207

LITHIUM CORPORATION
PLANT AT
BESSEMER CITY, N. C.



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ALL-OUT BOILER PERFORMANCE LIKE LITHIUM CORP. IS GETTING

Lithium, the "Horatio Alger" metal, is making an impact on every segment of industry... and Lithium Corp. of America's plant at Bessemer City, N.C. is meeting the mushrooming demand by peak load refining. This processing requires high pressure steam for vacuum jet equipment, a load of 60,000 lbs. per hr. at 140 psi. on the two Bros Packaged Boilers.

This peak load boiler performance is important, of course. Another big point in the Lithium plant boiler room is nominal maintenance; water tube inspection of these Bros boilers after 15 months of near-capacity operation showed *no scale formation.*

That's the kind of performance that makes a real hit with boiler engineers; yet Bros-engineered flexibility and economy pay off in the front office, too. Here's why:

Complete factory-assembled units. Bros Packaged Boilers are self-contained units, easy to transport and easily installed at low cost. They go on-the-line with simple service connections... no time or money wasted on slow, costly erections at the plant. These boilers quickly respond to varying loads; they supply steam requirements often expected only of larger, more expensive boiler equipment.

Capacities range from 4,000 lbs. steam per hour and up. Whatever your steam needs, Bros has the precise Packaged Boiler for the job. These units burn oil, gas, or both. Equipped with fully automatic, semi-automatic or manual controls.

WRITE TODAY for your free copy of the Bros Packaged Boiler brochure.

BROS

WM. BROS BOILER & MFG. CO.
POWER DIVISION
1057 Tenth Ave. S. E.
Minneapolis 14, Minnesota

APPOINTMENTS

Corporation executive changes

Westinghouse Air Brake Co: A King McCord, president. **The Oster Manufacturing Co:** Roger Tewksbury, chairman of the board; T S Bonnema, president. **Richardson Scale Co:** Arthur J Burke and William Hamilton, vice-presidents. **Cambridge Corp:** John M Eagleson and James A Graham, vice-presidents. **Kuhlman Electric Co:** Joel H Watkins, vice-president, sales; Arthur V Hughes, vice-president, engineering. **Hupp Corp:** Fred W Hottenroth, vice-president, technical sales.

Operations executive changes

Superior Tube Co: John B Giacobbe, director of nuclear products division. **Hoffman Laboratories, Inc:** Joseph L Dooling, director of contracts division. **Carrier Corp:** Everett P Palmatier, manager of transportation equipment division; Dewey J Sandell, director of research. **Armour Research Foundation:** James E Ash, supervisor of the fluid mechanics and fluid power section.

Engineer changes

Westinghouse Electric Corp: new engineering department managers are; J W Batchelor, turbine-generator dept; M R Lory, ac motor and generator dept; E H Myers, dc motor and generator dept; E C Whitney, waterwheel and synchronous condenser dept; G L Moses, services dept; R A Baudry, development dept. **Allis-Chalmers Manufacturing Co:** new engineers-in-charge are; Ellis P Hansen, mechanical design; A Clifford Holmes, steam design; John K Dixon, development section; Francis E White, marine and navy turbine sales.

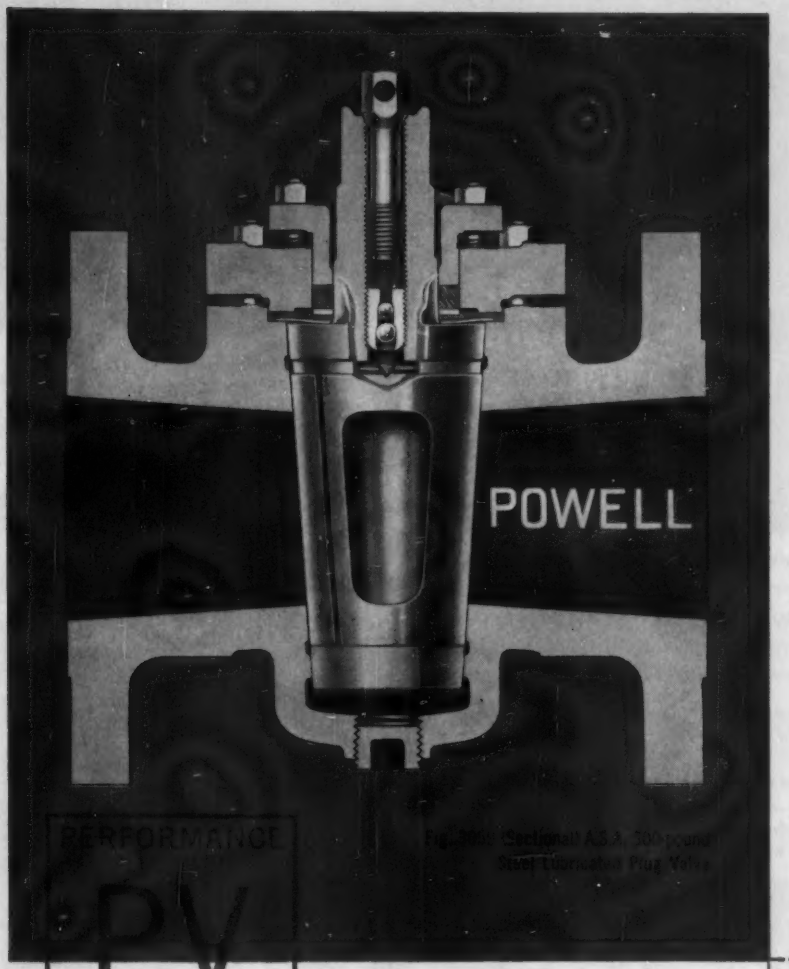
Bituminous Coal Research, Inc: John W Tieman, supervising engineer of Columbus laboratory. **National Research Corp:** Arthur G Walsh, director of process engineering dept. **Leeds & Northrup Co:** George D Fowle Jr, supervisor in charge of steam power in market development division. **Henszey Co:** Raymond E Paul, manager of power plant specialties division.

New sales managers

Combustion Engineering Inc: Robert M Hatfield, general sales. **Industrial Plastic Fabricators, Inc:** James P O'Connor Jr, general sales. **Barber-Colman Co,** Wheelco Instruments Division: H H Kieckhefer, general sales. **Bridgeport Brass Co;** C Lawrence Bulow, condenser and heat-exchanger tubes.

McKiernan-Terry Corp, Mead-

Powell Lubricated Plug Valves



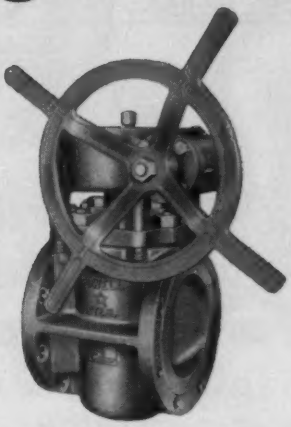


FIG. 1559G—150-pound Steel Lubricated Plug Valve. Gear operated

FIG. 2200—175-pound W.O.G. Semi-Steel Lubricated Plug Valve

Powell Lubricated Plug Valves maintain the 110-year tradition of quality and precision. Only the finest available materials are used. And painstaking quality control is rigidly enforced through each and every step of manufacture.

Valve users who want one source of supply for lubricated plug as well as all types of bronze, iron, steel and corrosion-resistant valves will want full details on Powell Lubricated Plug Valves.

For example, features include quick and positive operation—just a quarter-turn to open or close. Lubricant grooves surrounding each port provide a positive seal when the valve is closed. In an open position, seating surfaces are not exposed. Available in Steel and Semi-Steel through distributors in principal cities.

For full details, write for the new PV-4 Catalog on Powell Lubricated Plug Valves. Just fill out the coupon and mail. Of course there's no charge, no obligation.

THE WM. POWELL COMPANY
2525 Spring Grove Ave.
Cincinnati 22, Ohio

Gentlemen:

Please send me a copy of your PV-4 Catalog on Powell Lubricated Plug Valves. It is understood that there is no cost, no obligation.

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*title*_____

*company*_____

*city*_____

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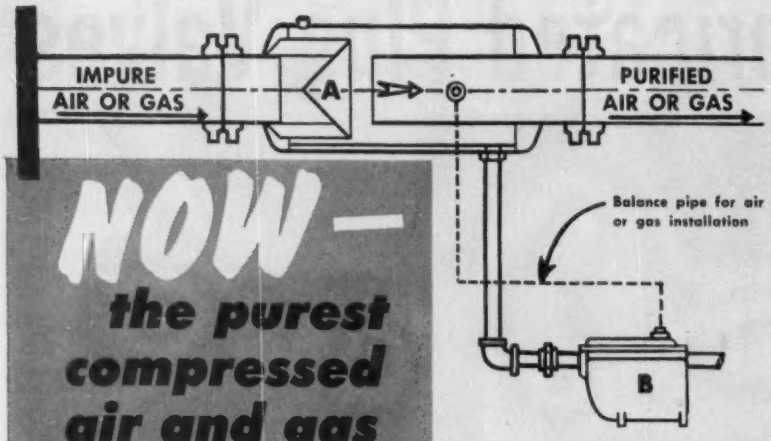
BRONZE, IRON, STEEL AND CORROSION RESISTANT VALVES.

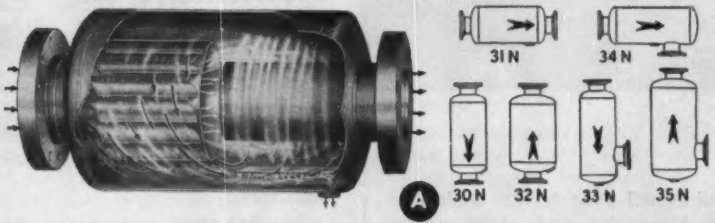


NOW— the purest compressed air and gas is yours with this W-A equipment

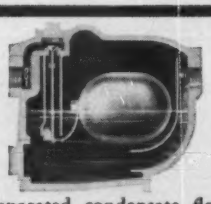
GUARANTEED TO REMOVE 99% OR MORE OF ENTRAINED MOISTURE AND SOLIDS

Where pipe lines carry compressed air and gas, liquids and solids are generally entrained in the gas stream. Wright-Austin 30N Series Separators can be used to remove foreign matter on a wide range of applications. For operating pressures to 5000 PSIG. Line sizes to 24". Here are some typical applications:

REMOVE
- —oil and water from compressed air supply lines
- —oil and water on compressed air service at outlet of inter-cooler and after-cooler equipment.
- —oil, moisture and tar between stages in coke oven gas compressors
- —oil and water from CO_2 gas lines
- —oil and water from hydro-carbon lines
- —entrainment from vapor lines following evaporation



This Wright-Austin separator employs centrifugal force to remove impurities from steam, air or gas flow. The pressure drop is extremely low. Type 31N, as well as other models shown, is light weight, compact and sturdily constructed according to ASME code.



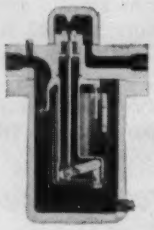
23-AC TRAP (0-125 PSIG)

Separated condensate flows to trap. Drainage is automatic. Particularly adapted where cold, gummy, emulsified cylinder lubricants make ordinary traps inoperative.

B

101-AC TRAP (0-600 PSIG)

Cast steel body, cover and bonnet. Designed for draining condensate where high pressures are involved. Internal mechanism all attached to cover for easy service.



WRIGHT-AUSTIN COMPANY
3245 WIGHT STREET • DETROIT 7, MICH.

WRITE FOR NEW CIRCULAR 506-A

More APPOINTMENTS

Begins on page 244

Morrison Division: James L Hamilton Jr, Western district. **Nickel Cadmium Battery Corp:** Melville E Ingalls, Eastern district. **Houghton Laboratories Inc:** Lloyd A Dixon Jr, West Coast area. **The Bristol Co:** S E Gewin, Chicago district. **Cutler-Hammer, Inc:** B R Stratton, Atlanta.

New representatives

For **Hills-McCanna Co:** Rittelmeyer & Co, Inc, 150 Nassau St, NW, Atlanta 1, Ga. For **Schutte and Koerting Co:** W John Schwing, 4007 Bellaire Blvd, Houston 25, Texas. For **Armstrong Machine Works;** R J Denton Co, 140 Dickerson St, Syracuse 4, N. Y. For **Hungerford & Terry Inc:** Edward H Aldworth, 2625 NE 13th Ct, Coral Ridge, Ft Lauderdale, Fla., and North-Monsen Co, 3520 S State St, Salt Lake City, Utah.

For **Fisher Governor Co:** Crabbe & Stebbins Co, Englewood Cliffs, N. J. and Albany, N. Y. For **Orr & Sembower, Inc:** General Equipment Sales, Inc, 605 Mills Bldg, El Paso, Texas; Albert F LaReau, 8 Valley View Dr, New Windsor, N. Y.; Thermal Engineering Co, 1492 Major St, Salt Lake City, Utah; Richardson Equipment Co, 612 Front St, Boise, Idaho.

For **Perkin Engineering Corp:** Northport Engineering, Inc, 186 N Fairview Ave, St. Paul 4, Minn. For **Kaye & MacDonald, Inc:** R H Langer Engineering Co, Delafield, Wis. and at 5625 W Wells St, Milwaukee, Wis.; Tennessee Heating Sales Co, 166½ Blount Ave, Knoxville, Tenn.; H-W Engineering Co, 349 Cypress St, Oakland 20, Calif.; North-Monsen Co, 2520 S State St, Salt Lake City, Utah.

Recent purchases

New York Air Brake Co: acquisition of Optical Film Engineering Co. **H K Porter Co, Inc:** purchase of Electric Service Mfg Co. **Solvent Service Inc:** acquisition of Lemont Chemical Co.

Consultant changes

Pope and Evans; new firm located at 21 E 40th St, New York 16, N. Y., specializing in industrial power. **Salvatore S Guzzardi:** J James Mirabile has joined the firm as industrial engineering consultant.

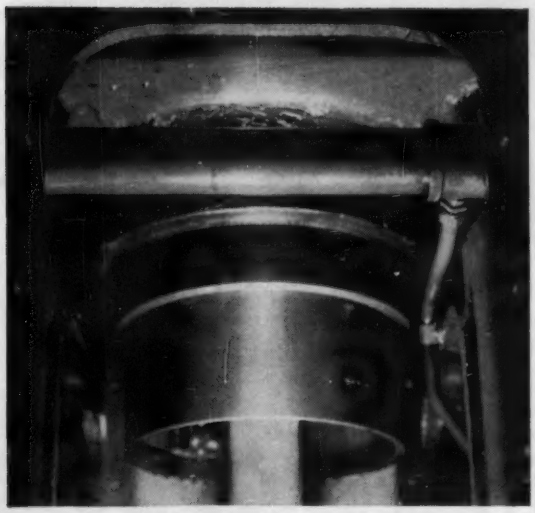
Obituary

Ralph D Jennison, 70, former president and chairman of the New York State Electric & Gas Corp, on July 26th following a heart attack. He had been identified with the public utility field for more than 46 years, including 41 years with NYSE&G and its former affiliates. He retired as chairman of the board on Dec 31, 1955.

(l. to r.) Carl Olbertz, Milford plant superintendent, "Rollie" C. Bleimehl, Standard Oil industrial lubrication specialist and Frank Morgan, Milford chief engineer inspect crankcase. Rollie Bleimehl is qualified to give technical service on jobs like this. He's been doing this sort of work for 10 years. Rollie has a mechanical engineering degree from Iowa State College and has completed the Standard Oil Sales Engineering School.

23,000 hours on original rings and bearings—no overhaul

Milford, Iowa, Light Plant gets this performance from engine using STANODIESEL Oil M



"As is" photo of piston skirt and interior of crankcase. No wiping or cleaning was done before photographing or at any time during 23,232 hours engine has been in service. STANODIESEL Oil M is the lubricant.

When a new 720 H.P. Superior engine was put in service at Milford, Iowa in 1949, the plant management knew what oil they were going to use—STANODIESEL Oil M. Their choice was based on previous experience with Standard diesel oils in other engines.

After 23,232 hours of operation, the engine at Milford is still operating with the original bearings and rings. It has not been overhauled. The crankcase, as shown in the photo, is clean. Pistons are clean and bright with no sign of wear. Twice yearly, oil samples have been taken for laboratory analysis. Each time the analysis has shown the oil to be in perfect condition. Good maintenance and STANODIESEL Oil M have contributed to this performance.

Got a hard job for an oil? STANODIESEL Oil M can do it. STANODIESEL Oil M has superior stability. Its additive formula helps to (1) prevent oil viscosity build-up (2) keep crankcase, pistons, cylinder walls and other parts clean (3) control foam (4) maintain film on difficult to lubricate areas and parts.

There's a Standard Oil industrial lubrication specialist near you in any of the 15 Midwest or Rocky Mountain States. Call him for more information about STANODIESEL Oil M. Or write Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

Quick facts about
STANODIESEL Oil M

- Keeps crankcase, pistons, cylinder walls clean.
- Combats deposit and wear problems imposed by use of economy fuels.
- Maintains film on difficult to lubricate areas and parts.
- Eliminates spark plug fouling in spark ignited engines and reduces combustion chamber ash deposits in engines burning natural gas, LPG and liquid fuels.
- Eliminates fuel injector and pump sticking caused by deposits on injector barrel and plunger where fuel and lube oil commingle.

STANDARD OIL COMPANY
(Indiana)

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BOOKSHELF

Fuel Injection Systems. *(Third Edition). 4½x6, 220 pp, illust, paper. $2.00. Diesel Publications, Inc, 80 Lincoln Ave, Stamford, Conn.*

This edition features new systems introduced since 1950 and added information on other systems. All new developments in fuel injection in the last six years are covered.

Eleven injection systems in common use on diesel engines are described. These include American Bosch, Bendix-Scintilla, Caterpillar, C.A.V. Limited, Cooper-Bessemer, Cummins, Fairbanks-Morse, General Motors, International Harvester, RoosaMaster, Sheppard and systems for dual-fuel engines. The last two chapters on maintenance and nozzle test data are extremely useful.

Theory and Practice of Lubrication for Engineers. *By Dudley D Fuller, Professor of Mechanical Engineering, Columbia University. 432 pp, 6x9, illust, $10.50. John Wiley & Sons, Inc, 440 Fourth Ave, New York 16, N. Y.*

This new addition to the literature in the fast growing field of applied lubrication fills a marked need for a well-written book which combines fundamentals with practicality. The author is exceptionally well-qualified for this work by virtue of his long experience as an educator and consultant in the field of lubrication.

Dr Fuller's premise is that once the principles of friction lubrication are thoroughly understood, they can be used repeatedly to meet the many problems that pop up in connection with practical lubrication.

After presenting a solid foundation in lubrication theory, the author applies the principles to a wide range of lubricating prpoblems. Numerous examples are worked out in discussions of these problems. Many bearing designs are given, including those for turbines, generators, large motors, rolling mills, ball mills and centrifuges.

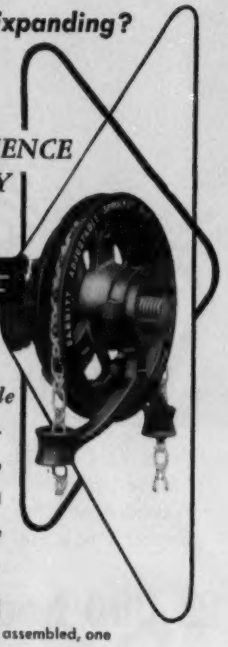
Safety Management, Accident Cost and Control. *By Rollin H Simonds, Professor of Management, Michigan State University, and John V Grimaldi, Director, Industrial Division, Association of Casualty and Surety Companies. 555 pp. 6x9, illust, $7.80. Richard D Irwin, Inc, Homewood, Ill.*

This book covers the principles of preventing and controlling work accidents in all types of business and industrial establishments. It states the basic fundamentals of safety engineering and management, and adds many new ideas. Shows how to calculate accident costs and how to detect production inefficiencies due to safety hazards. Includes the most recent changes adopted by the American Standards Association and the National Safety Council.

Material new in book form is found particularly in the chapters dealing with cost

Building or Expanding?

THINK of
SAFETY
CONVENIENCE
ECONOMY
THINK of



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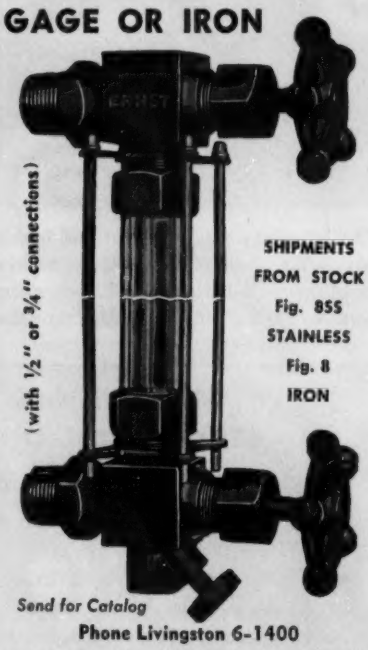

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SHIPMENTS FROM STOCK
Fig. 855 STAINLESS
Fig. 8 IRON

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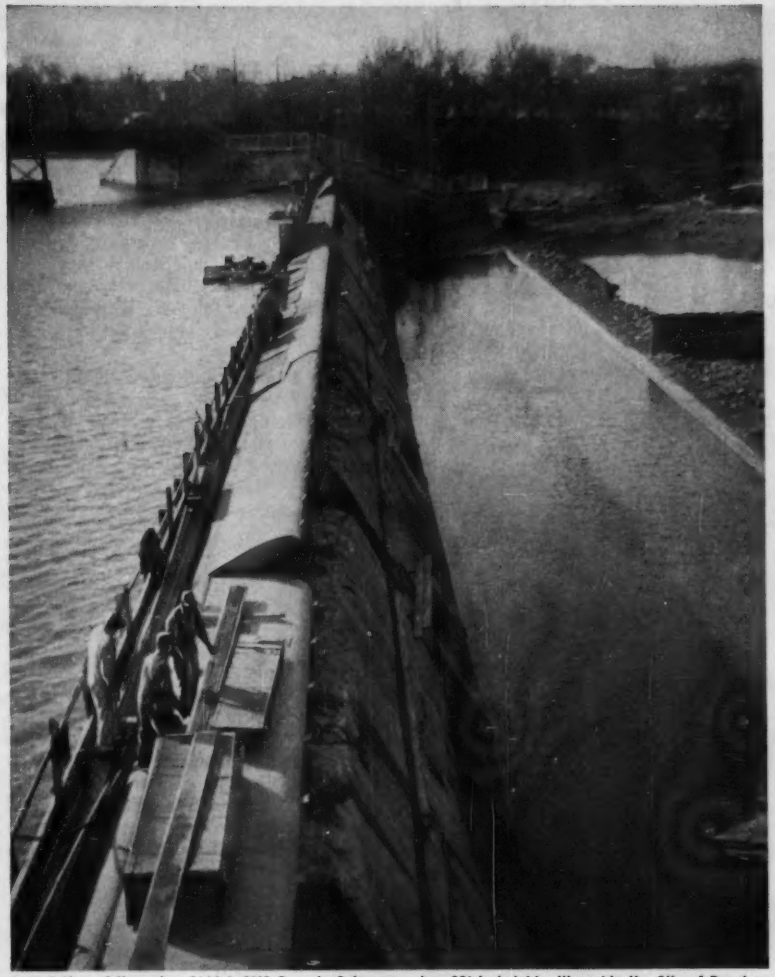

Installation of these two 5'-high SMS Bascule Gates on a dam 28' in height will enable the City of Decatur, Illinois, to more than double its present water storage capacity, even in dry years. The training wall and concrete pier between the gates is designed to minimize downstream cross-flow and damage to the apron. Harza Engineering Co., Chicago, Illinois, Consulting Engineers.

Individual 29'-long sections of the gate are installed in graphited bronze bearing shoes. A Bascule Gate was chosen over other types here when engineering studies proved it most economical and simplest.

View from downstream side shows final connection of one of the several hydraulic operating cylinders for each gate. Piping on the face of the dam immediately below provides individual isolation of any cylinder.

One of the two 500 psi oil accumulator tanks is about to be raised into position at the control station. Pumps supply pressure to the accumulator tanks for emergency operation in the event of power failure.

New SMS Bascule Gate Design Provides a CLEAR CREST, UNLIMITED LENGTH

Now SMS Bascule Gates can be built to any length you need, and installed without intermediate piers or overhead structures. With this new SMS design, hydraulic operators are located under the gate leaves and controlled from either end. The installation shown above consists of two 233'9" gates. They are the longest ever installed.

An SMS Bascule Gate will increase the storage and spillway capacity of existing dams quickly and economically. It enables you to control heavy run-offs without losing stored water, and to handle regional hazards like ice and heavy debris. In its open position, the gate lies flat on the dam crest and presents no obstruction to flow.

For full information on this new SMS Bascule Gate design—or on hydraulic turbines and other accessories—write to S. Morgan Smith Co., York, Penna.

S. MORGAN SMITH

AFFILIATE: S. MORGAN SMITH, CANADA, LIMITED, TORONTO

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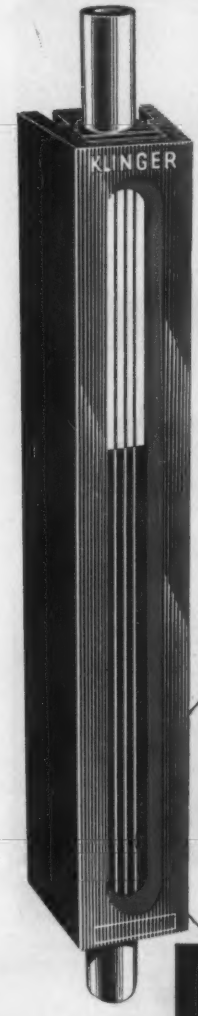

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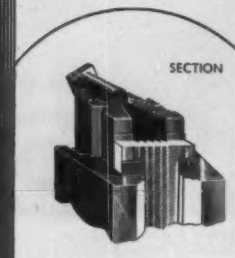
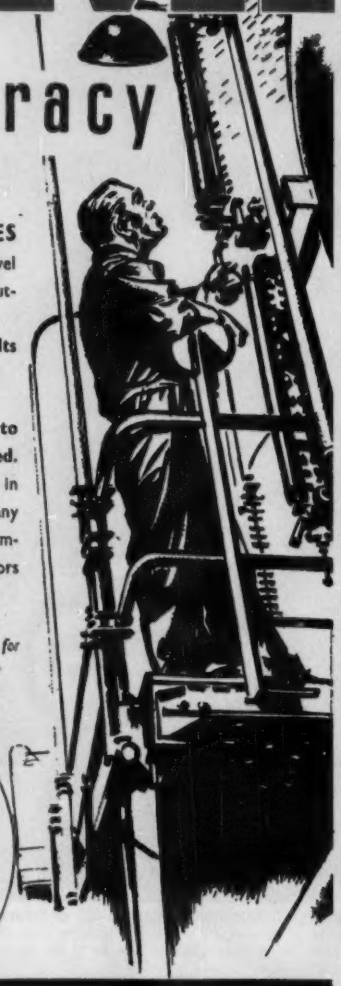
The "K" Type Reflex Level Gage has the following outstanding advantages:—

Single row of tightening bolts
Body free from distortion
Glass easily removed
Gage body turnable, free to expand, and easily removed.

The "K" Type Gage is made in a wide variety of sizes and any number of bodies can be combined to provide level indicators of any length.

Write to your Klinger agent for descriptive leaflets and literature.





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More BOOKSHELF

Begins on page 248

analysis, preparation for control of catastrophes and waste disposal. The authors emphasize the practicality of integrating safety principles into the framework of sound business management.

Intended primarily as a textbook for college level courses in accident prevention and safety administration, and as a general reference for the practicing safety specialist, this book will be valuable to anyone concerned with safety problems.

Design Manual, Roller and Silent Chain Drives. *Prepared for Association of Roller and Silent Chain Manufacturers by Jackson & Moreland. 95 pp, 8½ x 11, illust, hard cover, $3.50. Association of Roller and Silent Chain Manufacturers, P. O. Box 5398, Indianapolis, Ind.*

This manual offers engineering students a comprehensive presentation of the theoretical and practical aspects of roller and silent chain power drives. It is also a useful reference for practicing engineers and purchasing agents with mechanical power transmission problems.

The manual attempts to maintain a balance between practice and theory. It reviews the development of the chain drive since early days, compares chains, gears and belts, discusses manufacture of roller chain drive components, applications, and maintenance. The final chapter describes essential design and installation features of silent chain.

Electrons, Waves, and Messages. *By John R Pierce, Director of Electronic Research, Bell Telephone Laboratories. 309 pp, illust, $5.00. Hanover House, 575 Madison Avenue, New York 22, N. Y.*

This book is first in a projected series intended to explain the theoretical background and latest developments in each of several fields to engineers in other fields. The author develops electronic and wave theory starting with basic physical concepts; for example, electric and magnetic fields are treated with an analogy to gravitational fields. Mathematics are kept as simple as possible without sacrificing essential concepts. Numerous simple, clear line diagrams and sketches assist the text. Book is thorough but readable, using popular instead of a textbook approach. Emphasis is on fundamental theory rather than practical applications.

Sizing of Services, Meters and House Pipes. *By Oscar G Goldman, Supt, San Francisco Water Dept. 5½x8½, illus, cloth. $4.00. Columbia Graphs, Columbia, Conn.*

This book gives the answers to many questions concerning the correct sizes of services, meters and house pipes. Data and solution methods are based on investigation of over 7000 "poor-pressure" complaints.

Results are tabulated, while determination of the sizes of meters, service pipes, riser pipes and fixtures is reduced to convenient, easy-to-read charts.

Where would you get condenser tubes...

for the longest Steam Condenser in the world?

Jersey Central Power & Light Co. has what is reported to be the world's longest steam condenser in the Raritan River station, Sayreville, N.J. For this huge job, they chose *Chase* 60-foot Cupro-Nickel condenser tubes.

Good reason for this! Years and years of valuable condenser tube experience, coupled with modern, expert research facilities, have made Chase a leader of long standing in this field!

Specialists in the Chase Research and Development Group are constantly testing and experimenting—fighting corrosion problems in the laboratory and in the field.

Shipped from Chase mills in Waterbury, Connecticut and Cleveland, Ohio, literally millions of pounds of Chase Condenser Tubes have passed the toughest test of all—dependable, trouble-free service on the job! Like Jersey Central Power and Light Company, you, too, can add extra years to condenser tube life. *Simply insist on Chase!*

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The Case of WASTED HORSEPOWER

or

"Over-motoring" is outmoded by Dow Corning Silicones

SCENE: Pump room, Anyplant, U. S. A.

CHARACTERS: TINY H.—a 5 hp Class H motor insulated with Dow Corning Silicones. BLUSTER A. — a 7½ hp Class A motor.

TINY H: You're goofing-off again! Why don't you try moving a bigger load now and then?

BLUSTER A: Nuts to you, Tiny. I'm working hard enough keeping this little pump going.

TINY H: But you're strong enough to drive a bigger pump . . . or are you?

BLUSTER A: That's enough. I should worry—the engineers who put me here figured I might have to carry a 6 hp load—er—once in a while, at least.

TINY H: Sooo what! I'm rated to match our average load. My silicone insulated innards give me extra muscles to carry any overloads. Why—I could pump a 7 hp load and still be here when you're dead and gone.

BLUSTER A: Shut up, Tiny! Somebody might hear you.

TINY H: Okay, fat stuff, but you can't hide the facts forever. Mark my nameplate—one of these days the boss will figure out how much money you're wasting and you'll have had it.

You can match the load . . .
let Silicones carry the overload

Lazy motors cost money! Why continue to pay a fat premium for motors that make kid's play of their average work load? Today, you can save money by using silicone insulated motors rated to match your average load. Their built-in service factor of 25 to 50% will handle most intermittent overloads or loads that can't be matched in standard frame sizes.

Remember, over-motoring is outmoded

Get sources for silicone insulated equipment—mail coupon today

Dow Corning Corporation, Dept. 6910, Midland, Mich.

Please send me sources of supply for new Silicone (Class H) ☐ Motors ☐ Transformers

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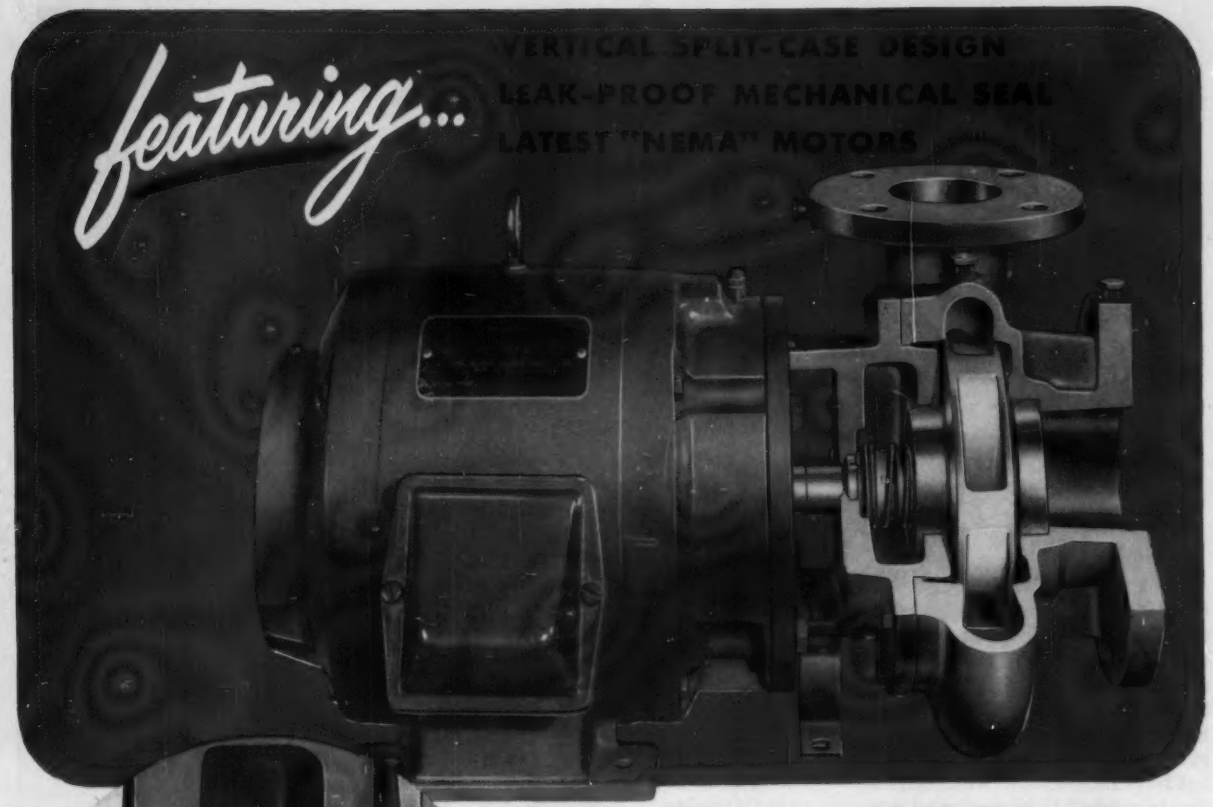
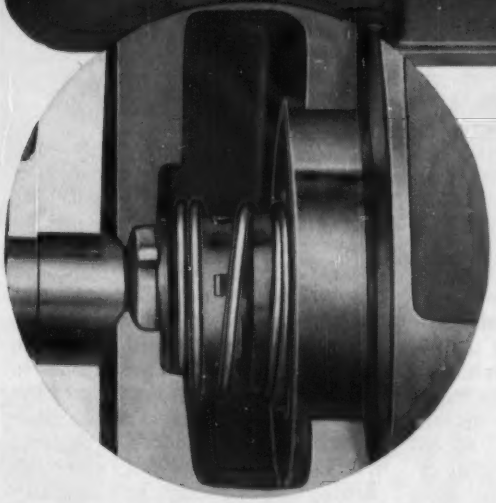




Leak-proof B&G "Remite" Mechanical Seal

B&G SERIES 1531 TYPE B
CENTRIFUGAL PUMP

In the B&G 1531 Pump you'll find an impressive array of efficiency and performance features which will satisfy your most critical appraisal—

The Motor. Heavy duty with extra large shaft and over-sized bearings. Deep grooved radial thrust bearing counter-balances thrust load. Available *as open, splash-proof, totally enclosed or explosion-proof units.*

Motor Pump Bracket. Barrel type for maximum rigidity,..counter-bored for perfect alignment. Support foot protects against vibration and strain.

Pump Shaft. High grade steel, super-finished for smooth, quiet operation and long life...oversized for minimum deflection. Gasketed sleeve protects against wear and corrosion.

B&G "Remite" Mechanical Seal. Eliminates leakage which occurs when a packing gland is used. A Carbon Seal Ring faces on a "Remite" floating seat—*a new material just a shade under a diamond in hardness*—gives trouble-free service when pumping liquid containing foreign material. The Seal is self-lubricating.

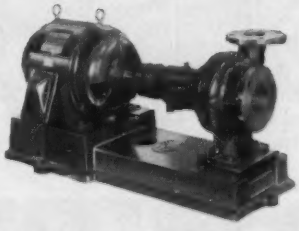
One piece volute and suction cover. Solid based with support foot. All the advantages of split-case design—no pipes to disconnect when servicing the pump. Rugged construction absorbs piping strains without transmitting stress to the motor shaft.

Impeller. Sound hydraulic design, mechanically balanced. Balance ring and relief holes reduce thrust. Precision fit on shaft assures easy removal and positive centering.

Capacities and materials. To 1100 GPM—420 ft. head. Available in all-bronze, all-iron and bronze-fitted units.

SERIES 1510 TYPE B CENTRIFUGAL PUMPS

Vertical split case construction, featuring balanced loading of impeller and bearings. Handles loads far in excess of those produced by any pump and motor combination. Easily serviced without breaking pipe connections.



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A complete line for water heating, process work, air conditioning and refrigeration. Send for literature.

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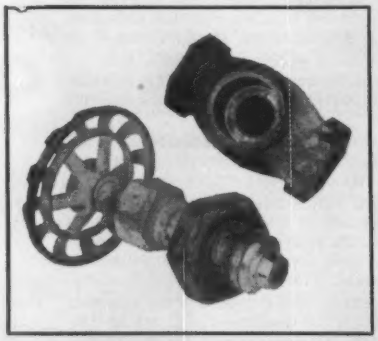
"I got 5 years of service from a valve I expected to last only 90 days"

Mr. C. L. Worthington, Chief Engineer for E. L. Bruce Co., Little Rock, Arkansas plant, standing near a Walworth No. 225P Bronze Globe Valve with "500 Brinell" stainless steel seats and discs that was installed in severe boiler blowdown service. Hardened seats and discs are especially resistant to wire drawing, steam cutting, or galling.

Some time ago Mr. C. L. Worthington, Chief Engineer for E. L. Bruce Co. plant at Little Rock, Arkansas, was having valve trouble on some newly installed boilers. The first boiler to go in service generated 600 hp operating at 200-pounds pressure. The water was so bad that a hot lime and soda ash water softener treatment had to be used, and it was necessary to add other chemicals to this solution from time to time. Mr. Worthington wanted to use a continuous blowdown to skim off the worst part of the scum on the water. He installed a small blow pipe about an inch below the normal water level in the boiler. This worked well, except that the one-inch valve on the line could only be partially opened and let a small part of the scum be blown off at one time. If the valve was widely opened, it would not take long to lower the water level in the boiler and run the steam pressure down. This service gave Mr. Worthington lots of valve trouble, as can well be imagined, because of the extreme wire drawing that occurred.



A Walworth No. 225P Bronze Globe Valve that gave perfect performance for four years and 362 days in a severe boiler blowdown service where the Chief Engineer said he had never been able to keep a valve more than 60 to 90 days.

One day the Walworth representatives in that area, called upon Mr. Worthington and demonstrated the outstanding features of the Walworth No. 225P Bronze Globe Valve. This valve, which has a working steam pressure rating of 350-pounds at 550°F, has a plug-type stainless seat and disc which has been heat treated to a minimum hardness of 500 Brinell. After listening to the Walworth men and examining a 225P valve, Mr. Worthington agreed that he would try one in the severe service described. He said if it lasted 90 days, he would consider that it had done a good job.

The valve went into service and came out within three days of being in service five years under very severe operating conditions. The valve was used 24 hours a day from early in the morning on Monday until Saturday night, when it was closed until the following Monday morning. It was never opened more than three-quarters of a turn, and most of the time it was opened only one-half to one-quarter of a turn. For the life of the valve, nearly five years, it never failed to give a 100% closure when shut on Saturday night until opened Monday morning.

When another 600 hp 200-pound pressure boiler went into service, it also was equipped with a one-inch Walworth No. 225P Bronze Globe Valve on the same service.

In view of the severe service and the wire drawing to which this valve was subjected, it is interesting to note that the original valve (which was taken out of service almost five years after it had been installed) was removed – not because the seat and disc were wire drawn – but because the turbulence of the steam had finally caused a small hole to occur in the wall of the body of the valve. Needless to say, the valve that was taken out of service was replaced immediately by another one-inch Walworth No. 225P Bronze Globe Valve, positive assurance that Mr. Worthington is satisfied that this valve has "done a good job."

Other Walworth products include complete lines of Gate, Globe, Angle, Check and Lubricated Plug Valves in bronze, iron, steel, stainless steel and special alloys. Complete information and literature will be furnished upon request.

WALWORTH

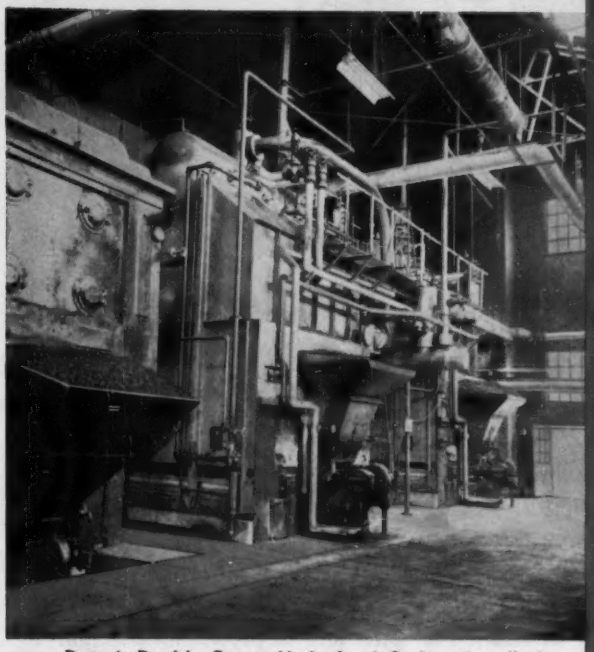
60 East 42nd Street, New York 17, New York

SUBSIDIARIES: ALLOYCO ALLOY STEEL PRODUCTS CO. CONOFLOW CORPORATION M&H VALVE & FITTINGS CO. SW SOUTHWEST FABRICATING & WELDING CO., INC. WALWORTH COMPANY OF CANADA, LTD.

Over One Million Pounds of Tomatoes Per Year Grown in 13 Acres Under Glass

Detroit Stokers Burn 140 Carloads of Coal Per Year

at the Wright Brothers Greenhouse Company, Toledo, Ohio.



Detroit Double Retort Underfeed Stokers installed in 1954. The J. A. Young Company, Toledo, Power Plant Contractors.

Detroit UniStokers installed in 1929.

Air view of Wright Brothers Greenhouse, Toledo, Ohio.

Thirteen acres of greenhouse take a lot of heat. And if you are growing tomatoes, a dependable heating plant is an absolute necessity as tomatoes are extremely sensitive to low temperature.

The Wright Brothers Greenhouse Company has depended on Detroit Stokers since 1929—and found them reliable.

TWO CONTRACTS

In 1929 five Detroit UniStokers with Babcock and Wilcox Stirling Boilers.

In 1954 two Detroit Double Retort Stokers with Babcock and Wilcox Type FF-15-32 Integral-Furnace Boilers.

All stokers and blowers are turbine driven.

Coal is elevated to the stoker hoppers by a tractor loader. Ashes are blown into an outside overhead silo.

Steam is for heating and also for sterilizing the soil before planting.

DETROIT STOKER COMPANY

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Works at Monroe, Michigan • District Offices In Principal Cities

When it comes to water conditioning . . .

HOW MUCH "TOLERANCE" CAN YOU AFFORD?

Very little, probably, if your plant is typical. You *know,* of course that exacting water treatment is required to make your local water supply precisely right for your use. But you know, too, that there are as many variations in water needs as there are industries.

As Elgin installations in hundreds of plants and institutions can testify, it is our business to design, build and install water conditioning equipment that will best meet your requirements — within exacting tolerances.

As specialists in water conditioning for nearly half a century, we have been face to face with nearly every water treatment problem imaginable. If, for example, your operations call for simple ion-exchange softening, Elgin can offer water softening equipment — in a wide range of capacities — together with an Elgin ion-exchange zeolite especially tailored to do the job with efficiency and economy. For boiler feed or process water, Elgin can provide filtration, neutralization, de-alkalization, de-aeration, de-mineralization or de-gasification. Even if you need water of *highest known chemical purity,* Elgin can offer you the Ultra-Delonizer . . . for water of greater chemical purity than that produced by triple distillation—*at a tiny fraction of the cost.*

Talk over your water conditioning problems with your Elgin representative. The entire Elgin engineering staff is at your service to help solve the problem quickly and inexpensively. Or, if you'd rather, please feel free to write directly to us for any information you may need.

ELGIN WATER CONDITIONING SINCE 1908

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130 No. Grove Avenue, Elgin, Illinois

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SOFTENERS ION EXCHANGERS FILTERS DEIONIZERS DEALKALIZERS LIME COAGULATORS DEGASITORS DEAERATING HEATERS

. . . there's enough difference to make ALL the difference

At final inspection, each individual Scovill Heat Exchanger Tube is checked for diameter, wall thickness, concentricity and length, to conform to permitted tolerances under pertinent specifications.

Inherent, however, in the quality of the alloys from which these tubes are drawn are many other distinctive "differences." Phosphorized Admiralty Heat Exchanger Tubes, for example, are initially hot extruded from billets made by Scovill's unique continuous casting process. In this process, continuous "blending" of the alloy from many melts produces exceptionally uniform metal . . . with even distribution of optimum inhibitor (phosphorus) content. The net result:—more perfect finished tubes . . . smooth, dense, free from surface defects . . . uniform in chemical composition . . . fully protected for long service life . . . delivered to the user in perfect condition.

On your next installation, let us show you how these "differences" in Scovill Heat Exchanger Tube can lead to superior field performance. A comprehensive range of standard tube alloys is available to meet every condition. Scovill's Technical Service is always ready to help you with special problems.

Scovill Manufacturing Company, Mill Products Division,
99 Mill Street, Waterbury 20, Connecticut. Phone Plaza 4-1171.

SCOVILL

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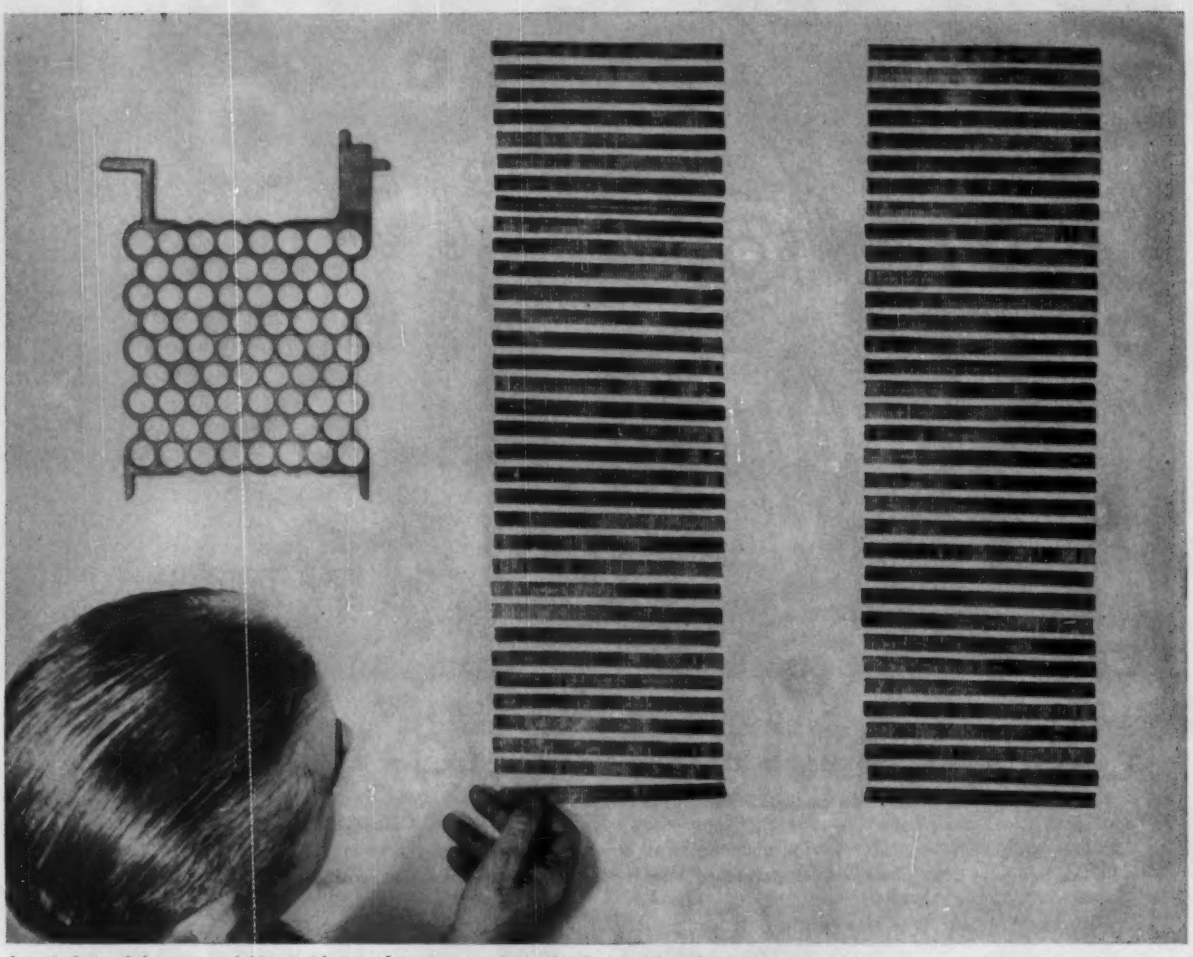
FOR APPLICATIONS FROM MARINE TO PETROCHEMICAL . . . FROM COMPRESSOR INTERCOOLERS TO "CAT-CRACKER" EXCHANGERS.

Phosphorized Admiralty • Admiralty • Arsenical Admiralty • Muntz Metal • Naval Brass • Red Brass, 85% • Deoxidized Copper
Arsenical Copper • Copper Nickel, 10% & 20% • Cupro Nickel, 30% • Aluminum Brass • Aluminum Bronze, 5% • Duplex Tube

176C98

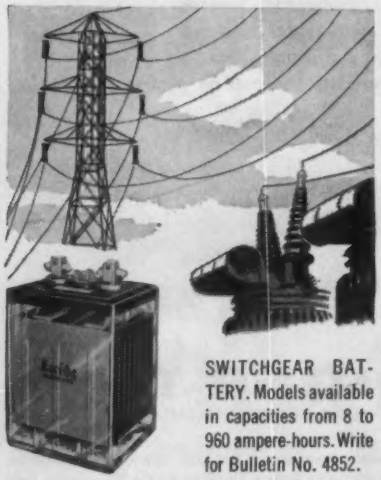
EXIDE-MANCHEX BATTERIES

For generating and substations



Actual photo of the unwound 68 spiral buttons from just one Exide-Manchex positive plate.

Enormous plate area multiplies battery life



SWITCHGEAR BATTERY. Models available in capacities from 8 to 960 ampere-hours. Write for Bulletin No. 4852.

Here's a mystery unwound. It's photographic evidence of the greater plate area of Exide-Manchex Batteries—one of the major reasons they can give such long life in so wide a variety of applications.

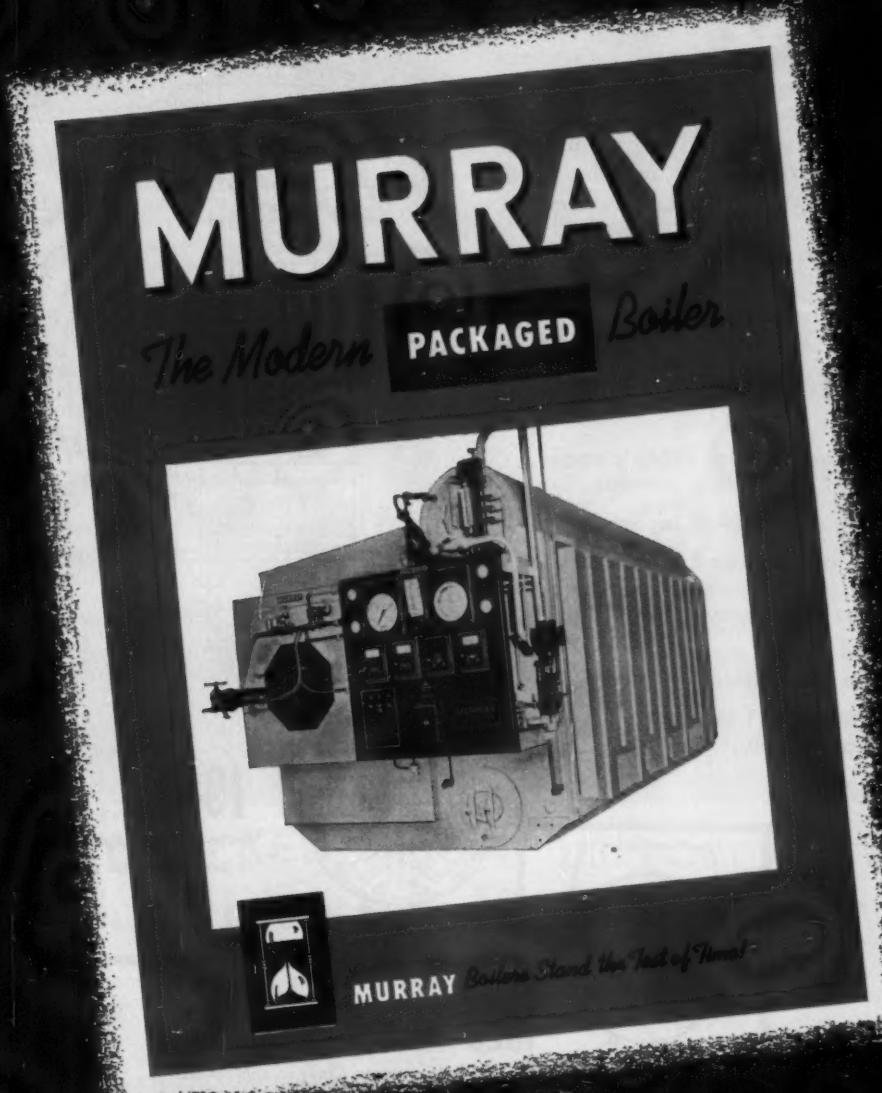
In the picture shown above, the spiral lead buttons from a single Exide-Manchex positive plate are unwound and laid flat on a table beside the empty grid. Look at the enormous actual plate area of the unrolled buttons—over five times as great as the plate size!

Think what this means for long battery life. Each part of the surface of the Exide-Manchex positive plate works easier to produce electricity than it would have to on a smaller area plate. The Exide-Manchex Battery can coast where many another battery is forced to strain. And active material lasts years longer than it otherwise could.

This unique construction feature of Exide-Manchex Batteries is only one of the many reasons for their long life. When you order batteries for floating service applications, or the equipment that requires such batteries, be sure to specify Exide-Manchex. Write for detailed bulletin. Exide Industrial Division, The Electric Storage Battery Company, Philadelphia 2, Pa.

Exide®

Dependability with Economy!



MURRAY packaged boilers are designed to meet today's need for compact, low cost, reliable heating and generating plants . . . When you install a MURRAY packaged boiler, you get the benefit of over 85 year's experience exclusively in the manufacture of boilers and allied products . . . Write for new folder, "MURRAY, The Modern Packaged Boiler," which gives complete information.

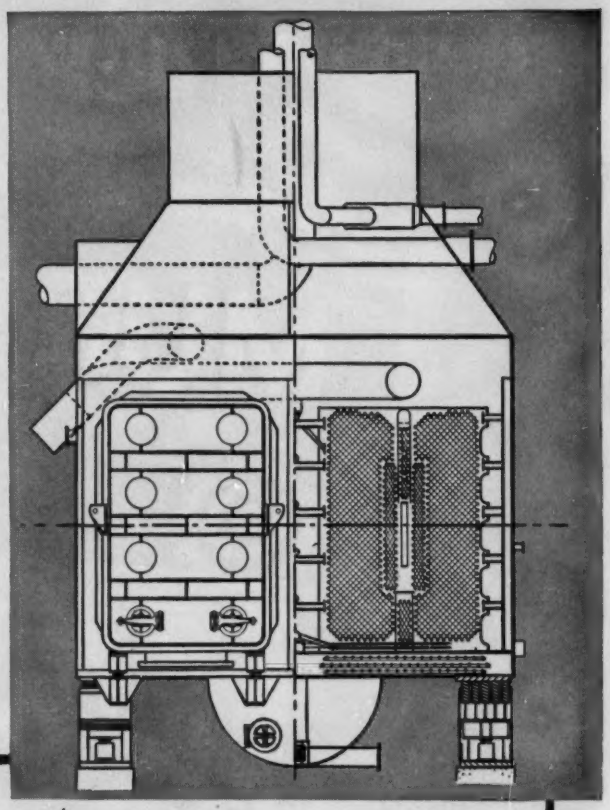
MURRAY IRON WORKS COMPANY · BURLINGTON, IOWA

Modern Dual Bank Condensers . . . . . by C. H. WHEELER

For 40 years C. H. Wheeler has led in steam power plant condenser design, from the first Dual Bank Condenser introduced to this country in 1916 to the most modern design for today's huge turbine-generators.

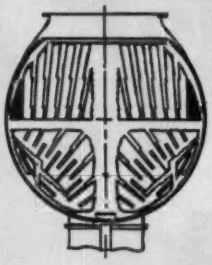
The latest C. H. Wheeler Dual Bank Condenser design for the largest metropolitan utility will provide 187,000 sq. ft. of surface to condense 1,600,000 pounds of steam per hour at 1.86 in. Hg. abs.

On the drawing boards now are new designs anticipating tomorrow's turbine requirements.

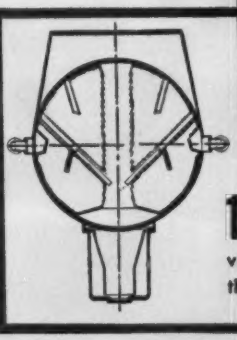


Modern Design Features.....1956

1. **Specifically designed for today's larger, more efficient generating stations.**
2. **Adaptable to your station layout.**
3. **Lower pressure drop and higher vacuum. Additional steam lanes shorten path and resistance of steam travel.**
4. **"Zero" condensate temperature depression.**
5. **DEAERATION . . . 0.01 cc. per liter is attainable.**
6. **Airtight.**



1941 Additional steam lanes allowed steam to penetrate deeper. Further improvement in pressure drop. Better deaeration.



1923 Wider steam lane. Condensate temperatures corresponded to vacuum temperatures. Oxygen content less than 0.03 cc. per liter.

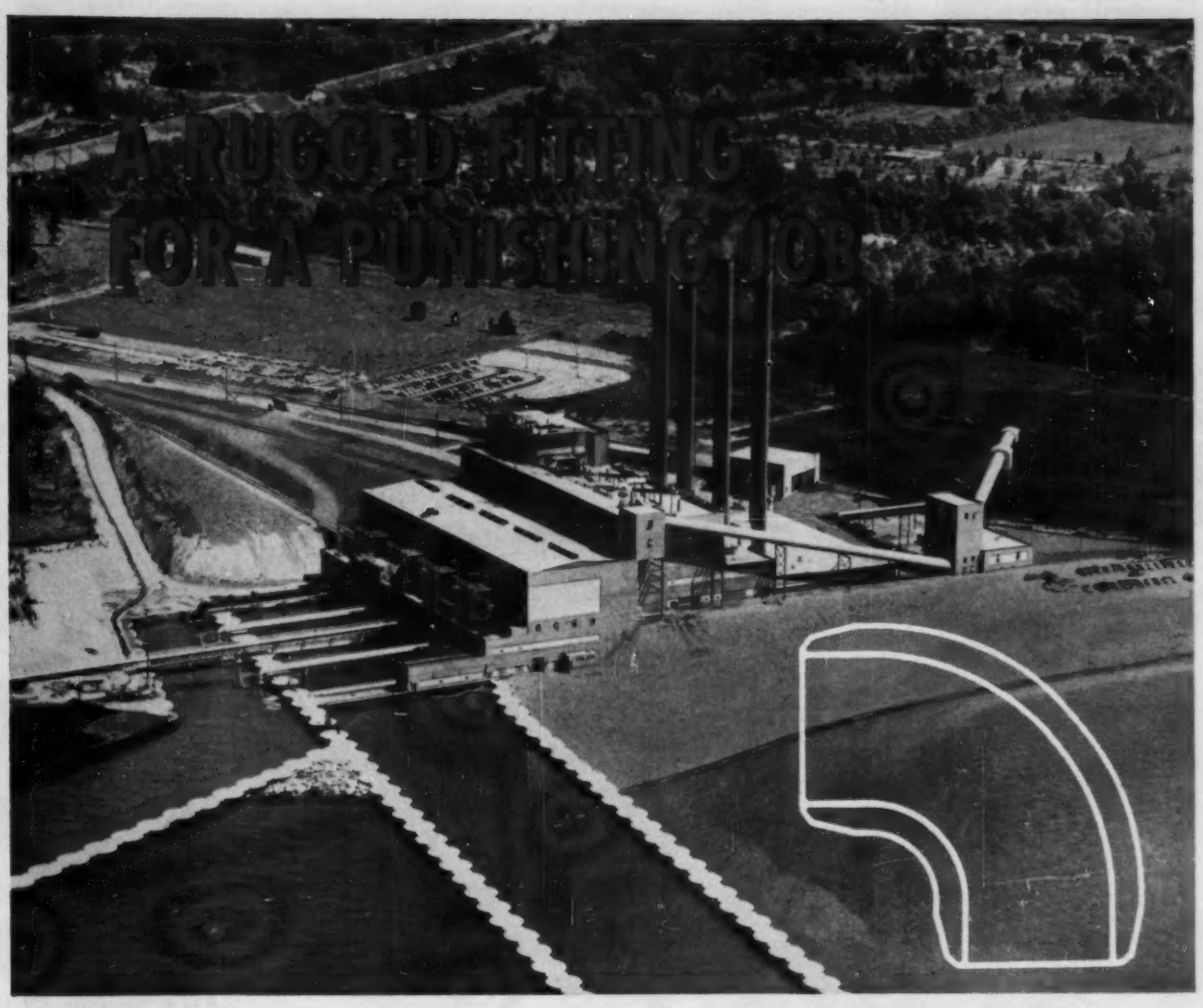
1916 An early C. H. Wheeler Dual Bank Condenser. Condensate temperatures approaching vacuum temperatures were achieved.

Let us tell you how our advanced designs will meet your operating requirements. Contact your local representative or

C. H. WHEELER MANUFACTURING CO., 19TH & LEHIGH, PHILADELPHIA 32, PA.

Manufacturers also of Vacuum Equipment • Marine Auxiliary Machinery • Centrifugal, Axial and Mixed Flow Pumps

C.H. Wheeler OF PHILADELPHIA



Extra Strong KEY-KAST 90° Ells Serve Heater at Cleveland Electric's Eastlake Power Plant

Steam lines leaving a desuperheater at The Cleveland Electric Illuminating Company may be subjected to abnormal erosion conditions.

To provide the durability needed to withstand this punishing treatment, 12" extra strong KEY-KAST 90° butt welding elbows were installed.

Long life and high resistance to wear are characteristic of all KEY-KAST fittings . . . manufactured under strict metallurgical control and available in all shapes, sizes and schedules to serve your piping needs better.

W-K-M MANUFACTURING COMPANY, INC.
A SUBSIDIARY OF acf INDUSTRIES INCORPORATED
PLANT: MISSOURI CITY, TEXAS • MAILING ADDRESS: P. O. BOX 2117, HOUSTON, TEXAS

JOB DETAILS

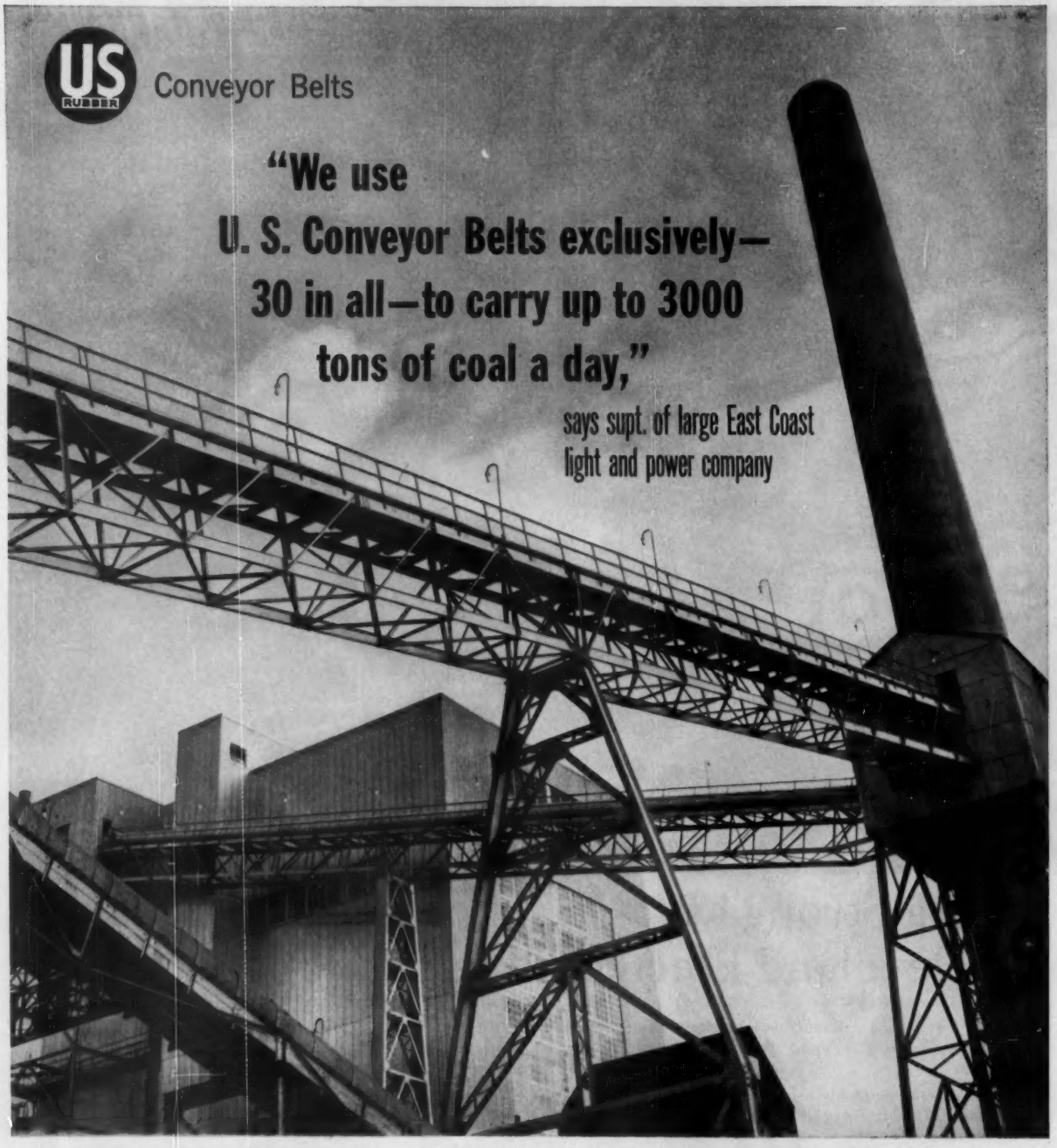
User:	The Cleveland Electric Illuminating Company Eastlake Plant, Eastlake, Ohio
Customer:	Pittsburgh Piping & Equipment Company
Fabricator:	Pittsburgh Piping & Equipment Company
Fittings:	12" extra strong KEY-KAST 90° butt welding elbows
Material:	5% Chrome, ½ % Moly, ASTM SPEC A-217 GR C5
Service:	Adjoining desuperheater
Conditions:	Severe corrosion and erosion Steam 438 PSIG @ 700°F.

MANUFACTURING

KEY RETURN BENDS AND FITTINGS

W-K-M THROUGH-CONDUIT GATE VALVES

acf LUBRICATED PLUG VALVES


US RUBBER
Conveyor Belts
"We use
U. S. Conveyor Belts exclusively—
30 in all—to carry up to 3000
tons of coal a day,"
says supt. of large East Coast
light and power company

The giant generating plant of this large New England light and power company, furnishes enough electric power for a city of 165,000 people. Thirty "U.S." Conveyor belts carry the 3000 tons of fuel in a round-the-clock operation.

"Our needs are constantly expanding," says the super, "and we intend to use 'U.S.' belts exclusively. Belting is the best way to carry coal . . . and the best belting is U.S. Rubber. Maintenance is usually confined to inspection and lubrication. We expect many years of service from these belts."

That's the story everywhere. High-volume operators are using "U.S." Belting, and the result is always *lower costs.* Like so many other successful belting installations, the system in this light and power plant is the result of United States Rubber's "Three-Way Engineering"—in which "U.S." engineers work with the engineers of the conveyor builders and engineers of the power company to turn out the best belt conveyor system for the specific job.

U. S. Rubber Conveyor Belts and expert engineering assistance are available at any of the 28 "U.S." District Sales Offices, or write us at Rockefeller Center, New York 20, N.Y.

Watch NCAA football, Saturday afternoons, NBC-TV

US RUBBER
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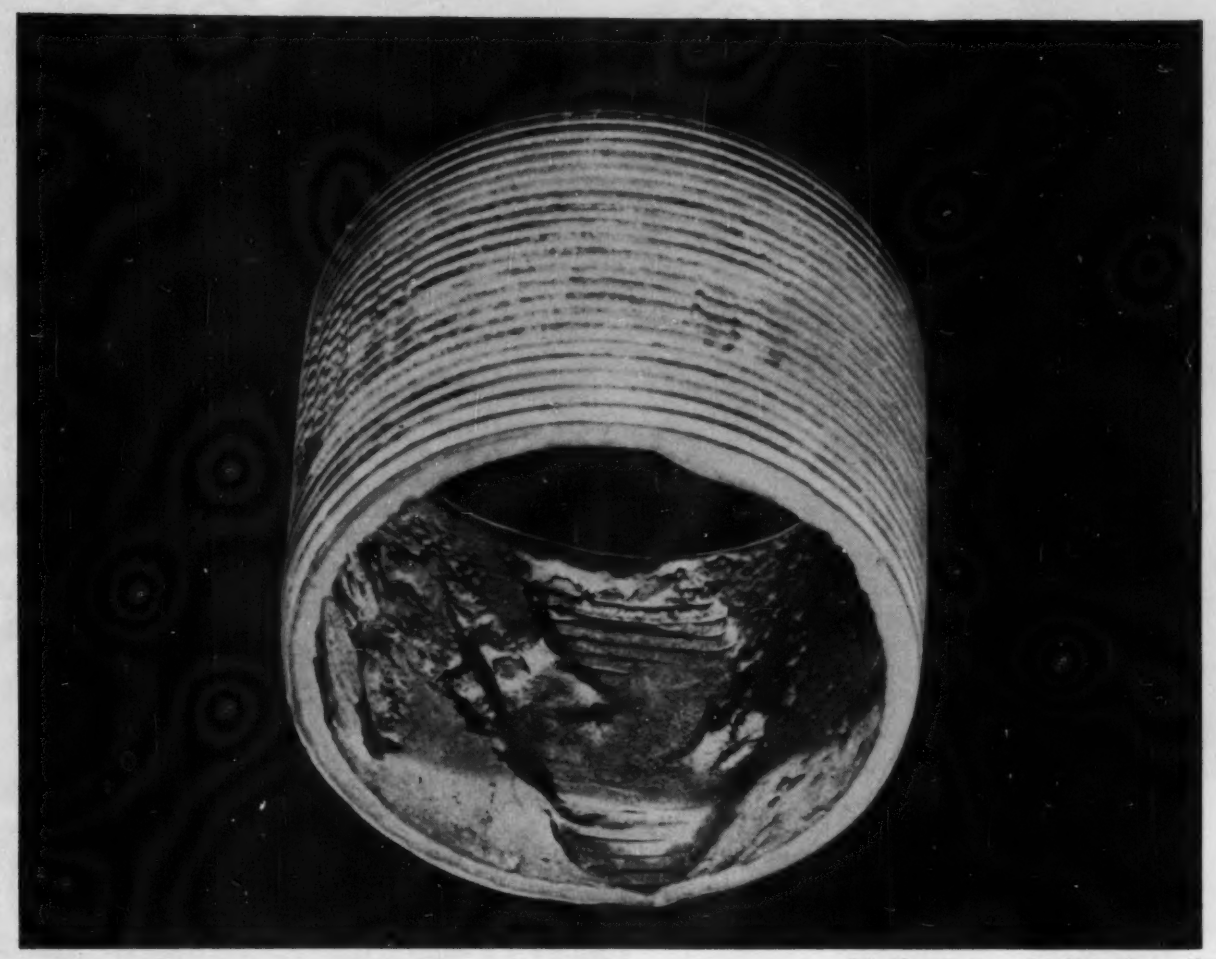


Return line corrosion resulting from carbonic acid

ALL pHOULED UP

pH—a symbol denoting the negative logarithm of the concentration of the hydrogen ion in gram atoms per liter. This scale permits the expression of both acidity and alkalinity in units which can be measured by means of a hydrogen electrode.

That's what chemists say about it. Some of the things that power plant engineers say about it are best left unquoted.

A low pH value in condensate can cause a power plant engineer a lot of trouble. When the pH value of water goes below 6.9, it's becoming acid—and when it's acid, it's highly corrosive. Then it begins to eat away at the internal surfaces of pipes and return lines.

Corrosion caused by low pH is most effectively prevented by the application of Dearborn's FILMEEN.* By forming a non-wettable, monomolecular coating on all metal surfaces with which treated steam or condensate come in contact, FILMEEN provides a protective, corrosion-inhibiting barrier between water and metal. By preventing the carbonic acid from touching the metal surfaces, FILMEEN thus keeps the lines corrosion-free.

When you find rusty condensate coming back to your boilers, it's time to see your Dearborn representative. He'll show you how FILMEEN will reduce excessive maintenance, avoid shutdowns and protect valuable equipment in your power plant.

**FILMEEN—U. S. Pat. No. RE-23614 reserves to Dearborn Chemical Company and its licensees exclusive right to the use of octadecylamine for water treatment.*

Dearborn®

Dearborn Chemical Company • Chicago 54

COMBATTING CORROSION EVERYWHERE SINCE 1887

Dearborn Chemical Company, Dept. PO
Merchandise Mart Plaza, Chicago 54, Ill.

Gentlemen:

☐ Send a copy of Bulletin 5013-B on FILMEEN.
☐ Have a Dearborn representative call.

Name.....*Title*.....

Company.....

Address.....

City.....*Zone*.....*State*.....

Burning coal the modern way cuts operating, labor costs for Inland Container

Expansion at the Indianapolis plant of the Inland Container Corporation required additional steam capacity. The expansion was complicated by the limited space available. Inland's Engineering Department, with the assistance of W. J. Barrows & Associates, Engineering Consultants, solved the expansion problem.

Today the power plant has a new 30,000 lb.-per-hr. boiler and also a 300-ton silo. Liberal use has been made of automatic controls; coal and ash handling have been completely mechanized. Now steam loads are adequately maintained. Boiler room performance has been highly satisfactory and economical. Furthermore, this modernization has enabled Inland Container to effect considerable savings by more efficient operation of its power system.

For further information or additional case histories showing how other plants have saved money burning coal, write to the address below.

NATIONAL COAL ASSOCIATION

Southern Building • Washington 5, D. C.

Consult an engineering firm

Designing and building hundreds of heating and power installations a year, qualified engineering firms can bring you the latest knowledge of fuel costs and equipment. If you are planning the construction of new heating or power facilities—or the remodeling of an existing installation—one of these concerns will work closely with your own engineering department to effect substantial savings not only in efficiency but in fuel economy over the years.

facts you should know about coal

In most industrial areas, bituminous coal is the lowest-cost fuel available • Up-to-date coal burning equipment can give you 10% to 40% more steam per dollar • Automatic coal and ash handling systems can cut your labor cost to a minimum. Coal is the safest fuel to store and use • No smoke or dust problems when coal is burned with modern equipment • Between America's vast coal reserves and mechanized coal production methods, you can count on coal being plentiful and its price remaining stable.

From coast-to-coast, A. P. GREEN warehouse stocks are available for immediate delivery to your plant . . .

You Lower Your Capital Investment . . . Your capital is not tied up in warehouse space.

You Lower Your Inventory Costs . . . You have on hand only the refractories you need . . . immediately.

You Lower Your Inventory Losses . . . You buy on current prices . . . there's no danger of losing money due to price declines or breakage while in storage.

You Increase Production Space . . . By freeing storage space for more profitable use.

You Lower Labor Costs . . . A. P. Green refractories are delivered to the point of usage. There's no inplant moving by your workers.

You Maintain Steady Production . . . With less down time. A. P. Green warehouse stocks are complete and are available for immediate delivery.

THERE'S AN A. P. GREEN WAREHOUSE STOCK NEARBY

. . . to Save You Money Six Ways

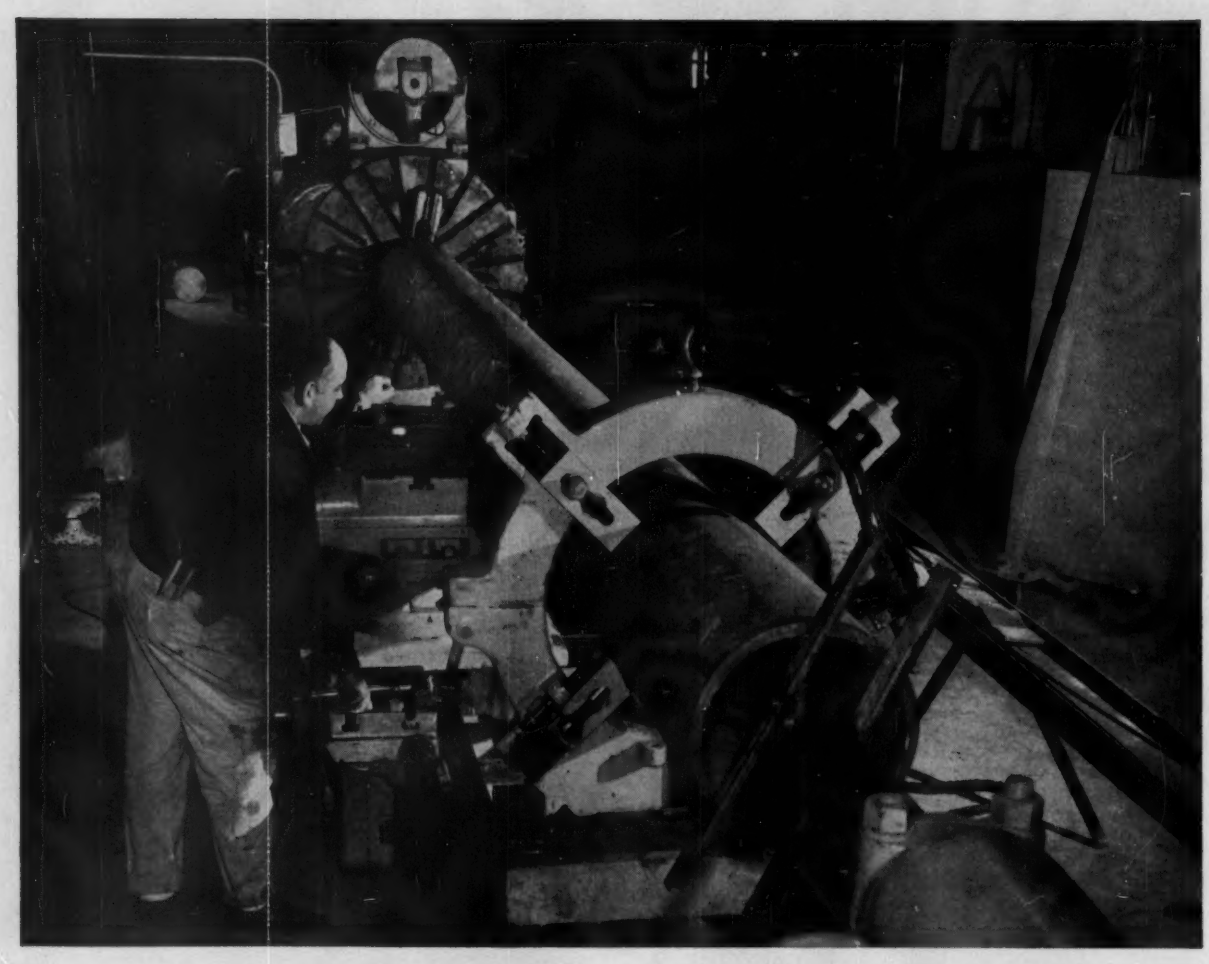
Look in the classified section of your telephone directory or write for the name of the A. P. Green distributor in your locality.

A. P. Green REFRACTORY PRODUCTS

A. P. GREEN FIRE BRICK COMPANY
Mexico, Missouri, U. S. A.

PLANTS: Mexico, Mo. • Woodbridge, N. J. • Sulphur Springs, Texas

In Canada: A. P. GREEN FIRE BRICK COMPANY, LTD.
Toronto 15, Ontario



ALCO FACILITIES ASSURE VALUE IN PREFABRICATED PIPE

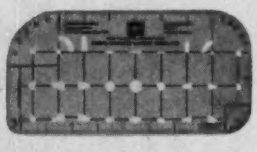
Machines and Methods at ALCO's Plant Handle All Sizes of Seamless Pipe, Any Alloy or Grade; Modern Welding Techniques Used for All Materials.

ALCO brings to prefabricated pipe production a modern plant, completely equipped with machine tools to handle any size, alloy or technique. Facilities include large lathes *(above)*, other heavy machine tools, induction heat-treating for joint preheat and stress relief after welding.

Advanced quality control methods are another important factor in ALCO prefabricated pipe. Use of X-ray machines and cobalt 60 pills to test welds is an example of up-to-date inspection and test procedures.

Experience and production know-how are also factors in ALCO prefabricated pipe. Pipe manufacture draws on welding techniques which have placed ALCO in a leading position in the welding field. ALCO's experience in heat-exchange equipment, both refinery and power plant, aids in piping manufacture.

Your inquiries on ALCO piping will receive prompt handling at any ALCO Sales Office, or, if you wish, write P. O. Box 1065, Schenectady 1, N. Y.



Information on how to obtain the ALCO piping drawing layout template, a definite aid in making piping layouts, is available from ALCO, P. O. Box 1065, Schenectady 1, N. Y.

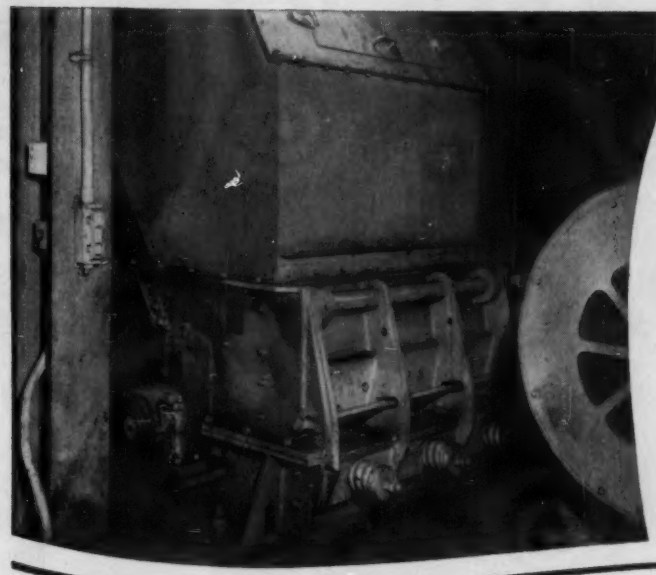
ALCO

ALCO PRODUCTS, INC.

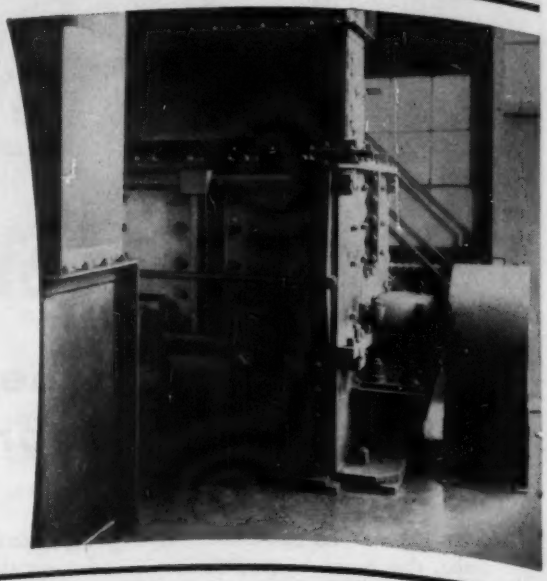
NEW YORK

Sales Offices in Principal Cities

Locomotives · Diesel Engines · Nuclear Reactors · Heat Exchangers · Springs · Steel Pipe · Forgings · Weldments · Oil-Field Equipment



which of these JEFFREY coal crushers will meet your needs?



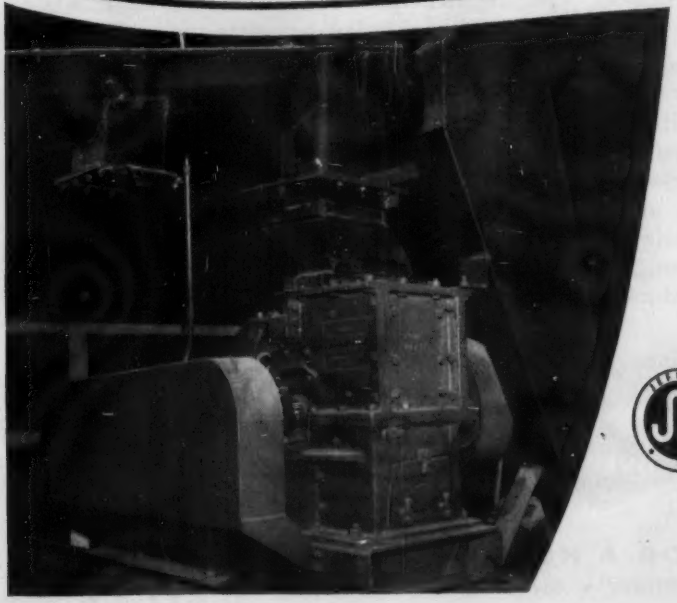
SINGLE AND DOUBLE roll crushers, FLEXTOOTH® and FLEXROLL® crushers, swing hammer pulverizers—Jeffrey makes all the popular types used in power plants, large or small.

Care in selecting the proper type of crusher means the difference between an efficient installation and one that bottlenecks coal moving through the plant.

Our engineers will gladly give you complete satisfaction on your problem, using their years of experience with every conceivable crushing case.

Jeffrey also offers the most complete test history file of any manufacturer of crushing equipment, plus a fully equipped laboratory where tests on coal in doubtful cases will be run at no expense or obligation to you.

For more information, write for Catalog 784-C. The Jeffrey Manufacturing Company, Columbus 16, Ohio.



Top: *42" x 66" FLEXTOOTH for coal reduction to minus 1" or ¾".*

Center: *42" x 82" Type B Reversible Swing Hammer for crushing coal down to minus ⅛".*

Bottom: *20" x 12" Type A-2 Swing Hammer Pulverizer for medium and small capacity plants, also in sampling operations. Reduction down to minus ½" to 10 mesh.*

JEFFREY

CONVEYING • PROCESSING • MINING EQUIPMENT
TRANSMISSION MACHINERY • CONTRACT MANUFACTURING

Now on the USS Saratoga
Unibestos insulation protects key pipelines

On the powerful *Forrestal*...on the sleek atomic subs, the *Nautilus* and *Seawolf*...now on the mightiest *USS Saratoga,* Unibestos pipe insulation guards against heat loss.

Nowhere else is dependable insulation needed more than on these ships of nuclear power and electronic control. Compactness, durability, thermal efficiency—all are important requirements. And Unibestos answers all three of these vital needs: *single-layer* construction for unmatched ease of installation...long lasting strength to withstand shock and vibration... positive heat seals at the innumerable hard-to-insulate joints and fittings.

By providing these unique standards of insulating efficiency, Unibestos makes its contribution to the important Navy development program. In addition to the marine field, single-layer Unibestos is fast becoming the preferred pipe insulation for more and more power plants, refineries, chemical plants and other modern industrial projects.

Unibestos® pipe insulation is available in sectional form through 44″ O.D.

Just Out!—the new Unibestos Handbook. Complete, compact, detailed, informative. Write for your copy on your company letterhead.

This new 40-page book serves as an important reference guide for selecting and specifying pipe insulation for every application.

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1111 West Perry Street • Bloomington, Illinois

For you

CLARAGE FAN COMPANY
619 Porter St., Kalamazoo, Michigan

Please send me literature on:

- ☐ Type NH fans for ventilating, air conditioning, and industrial services
- ☐ Type XL fans for industrial air and material handling
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- ☐ Ready Units—complete, "packaged" fans
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- ☐ Unit Heaters
- ☐ Mechanical Draft Equipment
- ☐ Air Conditioning Units, Air Washers, etc.
- ☐ General Catalog

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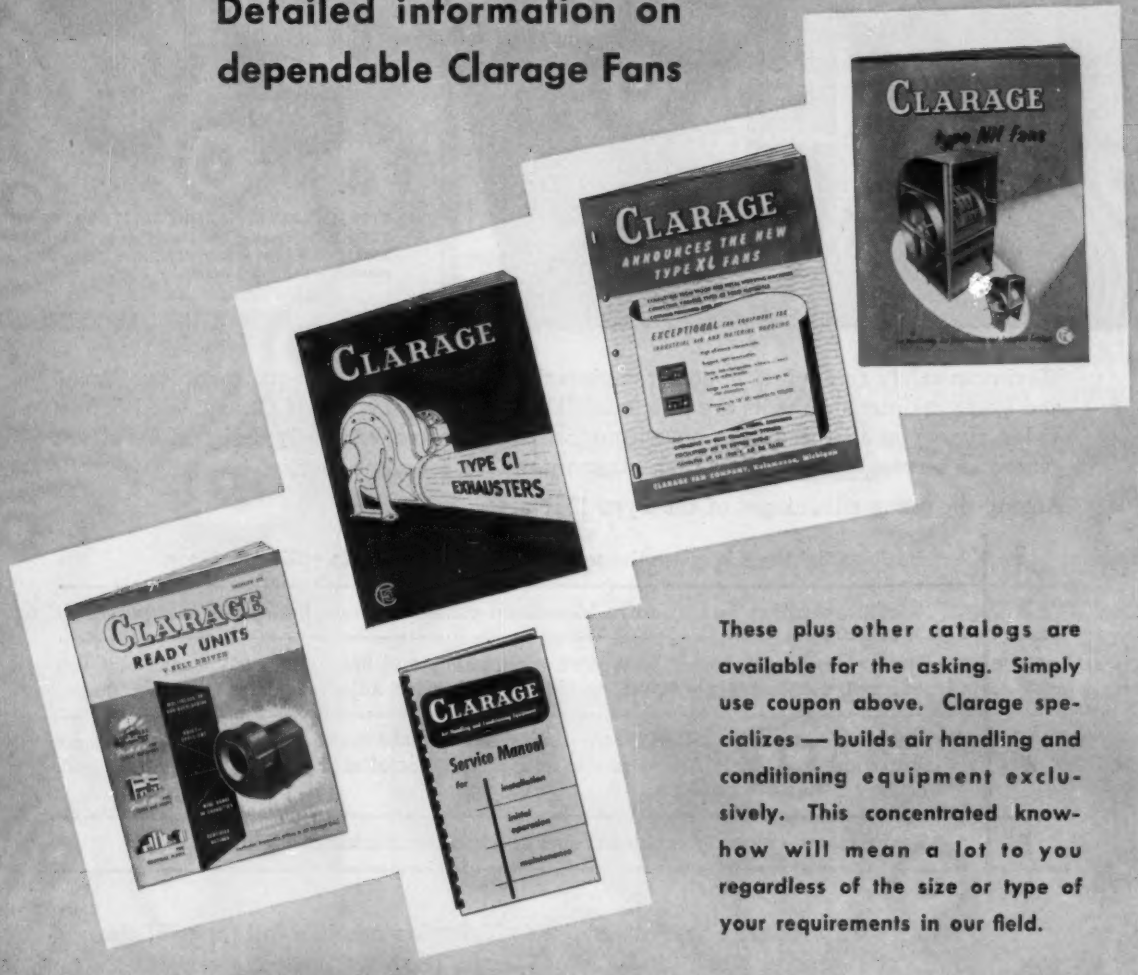
Detailed information on dependable Clarage Fans



These plus other catalogs are available for the asking. Simply use coupon above. Clarage specializes — builds air handling and conditioning equipment exclusively. This concentrated know-how will mean a lot to you regardless of the size or type of your requirements in our field.

CLARAGE

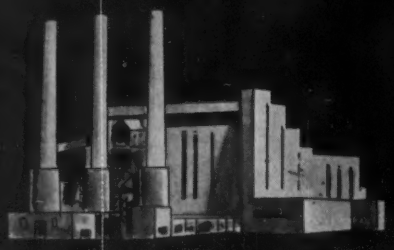
. . . dependable equipment for making air your servant

SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES • IN CANADA: Canada Fans, Ltd., 4285 Richelieu St., Montreal

GET GREATER SAFETY AT LOWER COST...

CHOOSE THE TYPE 1511

CONSOLIDATED SAFETY VALVE



TYPE 1511 CAST IRON BODY SAFETY VALVE
SIZES: 1½" through 6". **PRESSURES:** up to 250 psi. **TEMPERATURES:** up to 450° F. All sizes except 6" available with oversize flanges.

Maximum safety comes first in power engineering. But lower initial equipment investment and lower maintenance costs are also essential factors. The Type 1511 Consolidated Safety Valve gives you all three. It is an all-purpose safety valve, expressly designed for steam generator service, yet costs less than other makes for the same service.

Among the many advantages of the Type 1511 are:

1	Positive tightness because the seat is precision lapped to optical flatness.
2	Stable operation and uniform blowdown control because the spring is exposed.
3	Better alignment, easier blowdown adjustment and finer performance because the valve has an integral, double-guided combination adjusting ring and disc guide.
4	Cuts the cost per pound of steam discharged because maximum capacity is designed into minimum flange size. The size and/or number of safety valve nozzles required on any boiler are reduced.
5	Saves space – requires less headroom and smaller discharge piping.

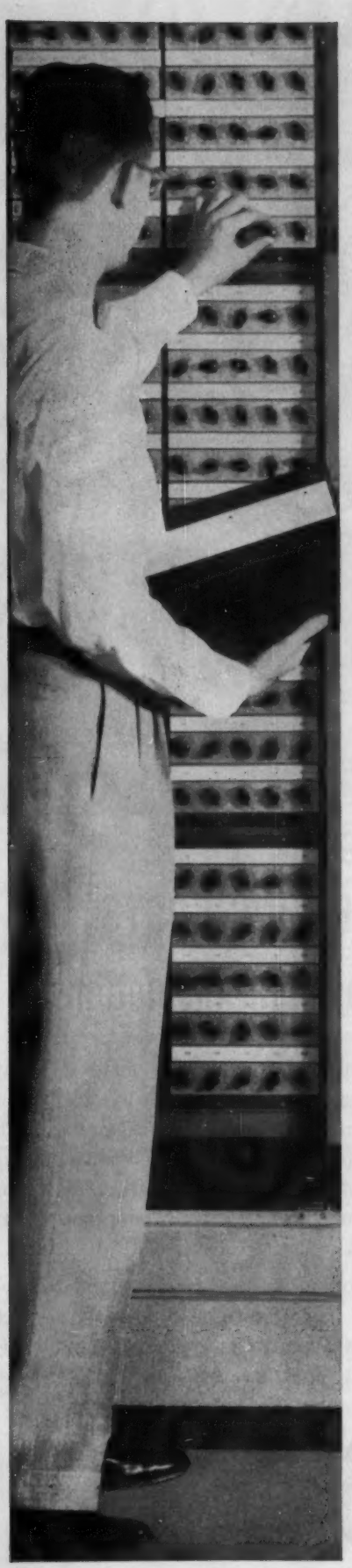
The Type 1511 Consolidated Safety Valve is made in a full range of sizes and orifices. Write for Bulletin 730 and learn the complete story of the greater safety and economy of the Type 1511.

In Canada: *Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario.*

CONSOLIDATED SAFETY VALVES

A product of **MANNING, MAXWELL & MOORE, INC.** STRATFORD, CONN.

MAKERS OF 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'ASHCROFT' GAUGES, CONSOLIDATED SAFETY VALVES, 'AMERICAN-MICROSEN' INDUSTRIAL ELECTRONIC INSTRUMENTS, *Stratford, Conn.* 'HANCOCK' VALVES, *Watertown, Mass.* 'CONSOLIDATED' SAFETY RELIEF VALVES, *Tulsa, Okla.* AIRCRAFT CONTROL PRODUCTS, *Danbury & Stratford, Conn. and Inglewood, Calif.* "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES, *Muskegon, Mich.*



Panalog Information Systems guide management in raising plant output and profit

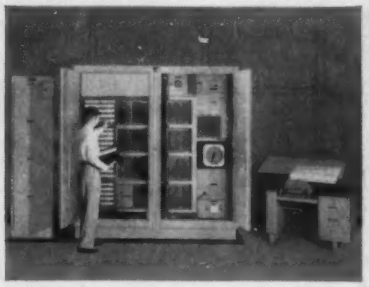
Panalog 605 Information System supplies management control information. Now, operating personnel and management can receive organized digital information on any process, instantly and continuously. Information can be presented in a variety of forms for immediate control action as well as for engineering and accounting analysis. A typical presentation method employs an electric typewriter and patented log chart. Readout can also be made on punched or magnetic tape, punched cards, or can be fed directly to computers.

Periodically logs and continuously scans. A precision servo measuring system quantizes process variables during automatic, periodic logging. A high-speed electronic measuring system detects off-normal conditions during continuous scanning of all variables. Normal and return-to-normal values are printed in black—off-normals in red. A complete log of all variables as well as a summary of off-normals can be made at any time.

Completely flexible and expandable. Panalog components are standardized, packaged modules. The system can be easily expanded or modified in the field. The Panalog 605 is sufficiently flexible to supply digital information for any management requirement.

Write for literature. Literature presenting a comprehensive treatment of the Panalog 605 is available. If you wish, a Panellit representative in your area will be happy to discuss the possibilities that a Panalog Information System offers your company.

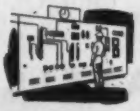
Full scale, adjustable, high and low off-normal limits are provided for each input variable. Basic system capacity, 200 points with one electric typewriter — can be expanded. Accuracy, ±.25% of full scale range. Logging speed, approximately one line per minute. Scanning speed, five points per second, between logs.



Logged values are grouped by processing unit on chart. Audio-visual alarms accompany detection of off-normals. When scanning, off-normal values are identified and printed in separate chart area. Totalized and averaged values as well as plant efficiencies can be automatically computed and recorded by the system.

U.S. Pat. No. 2,701,748

Engineered Information Systems For Industry



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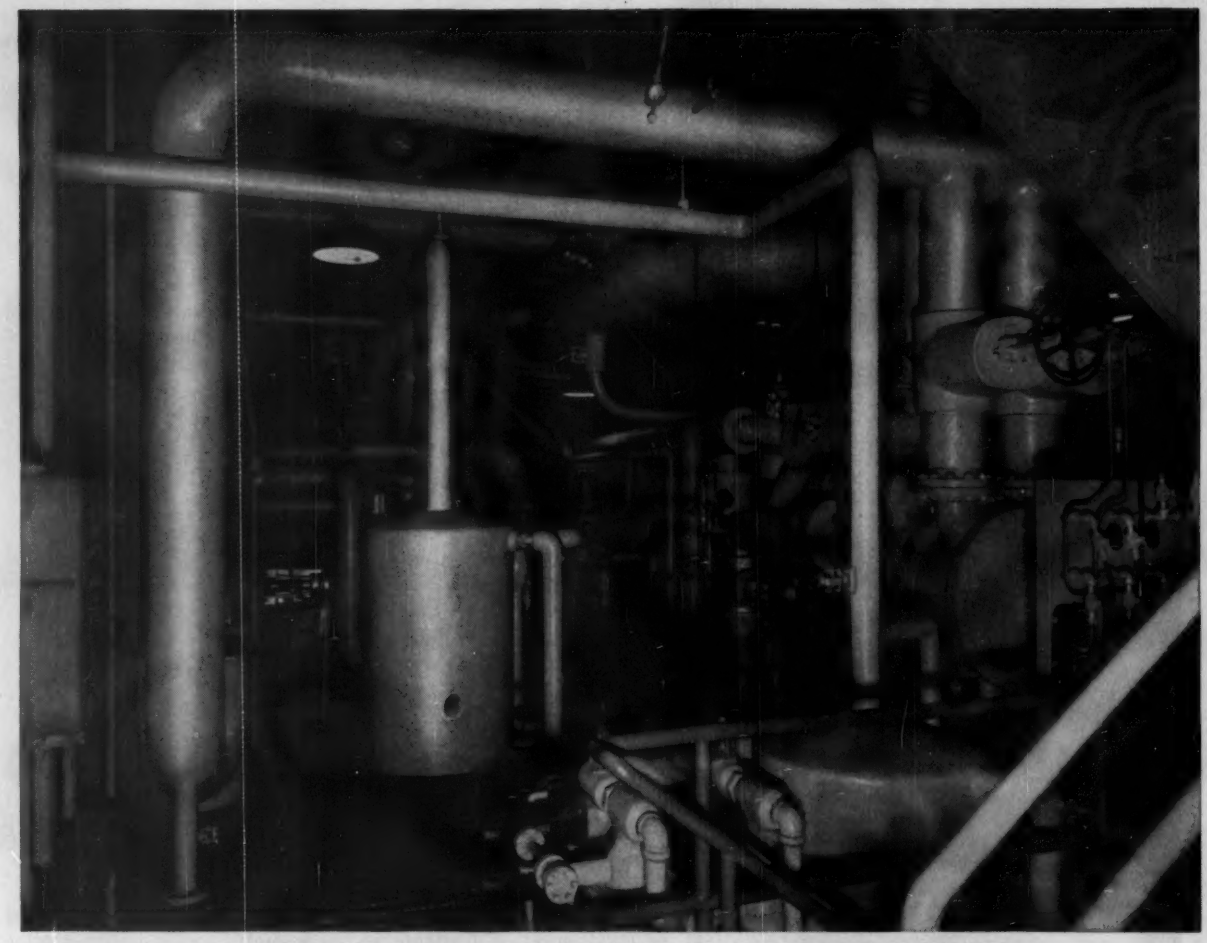

Condensate piping and heater drains in this power plant are insulated with 1½" K&M "Featherweight" 85% Magnesia. K&M insulations are also used on other equipment in the plant.

reduce HEAT LOSSES . . . *cut* OPERATING COSTS with K&M "Featherweight" 85% Magnesia Insulation

Every BTU lost through inefficient insulation directly increases operating costs . . . every BTU kept for work in the system is money saved. It's this dollars and cents view that indicates the need for K&M "Featherweight" 85% Magnesia . . . the EFFICIENT insulation that time does not harm.

K&M "Featherweight" is made of 85% basic carbonate of magnesia and asbestos fiber. It efficiently insulates piping and equipment to 600°F. and is good for the life of the equipment it serves.

For temperatures up to 1900°F. there is K&M Hy-Temp Combination. It's made of a layer of K&M Hy-Temp (diatomaceous silica) covered with "Featherweight" 85% Magnesia. These two layers are laid with staggered joints—thus, heat losses that normally occur through expansion-opened joints are eliminated.

For more information on these heat- and money-saving K&M High-Pressure Insulations, contact your K&M distributor, who is an experienced applicator. Or, write directly to us.

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

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Pacific Gas & Electric Co.

Central Illinois Public Service Co.
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*Central Stations and Utilities use... Graver Deaerating Heaters**

A partial listing of tray and spray-tray type installations with capacities up to 2,250,000 lbs. per hour.

*WRITE FOR MANUAL OF POWER PLANT INFORMATION

A COMPLETE LINE OF WATER TREATMENT EQUIPMENT

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Industrial Dept.: I-212

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Division of Graver Tank & Mfg. Co., Inc.
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Many Users Say This Belt Outlasts Them All

The Ray-Man Conveyor Belt features a new and different construction of covers and strength member to resist cuts, tears and abrasion to a degree never before attained. R/M's exclusive "XDC" Cover provides a degree of protection and long life not possible with any other belt. Inside this cover, Ray-Man Conveyor Belt combines elastic cushioned strength member plies in an envelope of strong, yet flexible synthetic fabric to resist gouging and tearing ... to take the impact of large, abrasive lumps... to permit the belt to trough easily and train naturally.

Like all Manhattan heavy duty conveyor belts, Ray-Man is moisture resistant and mildew-proof. It requires no breaker strip and holds fasteners considerably better than other types of belts. Let an R/M representative show you the advantages of Ray-Man as well as other R/M conveyor belts, including Homocord, with its extra cushion for unusually abusive shock loading. He'll help you select the belt best suited for your job . . . one designed to give you "More Use per Dollar." Write for Bulletins 6906 and 6915.

RM 600 P

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MANHATTAN RUBBER DIVISION—PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Brake Linings • Brake Blocks • Clutch Facings
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INSIDE STORY
on cooling tower pH

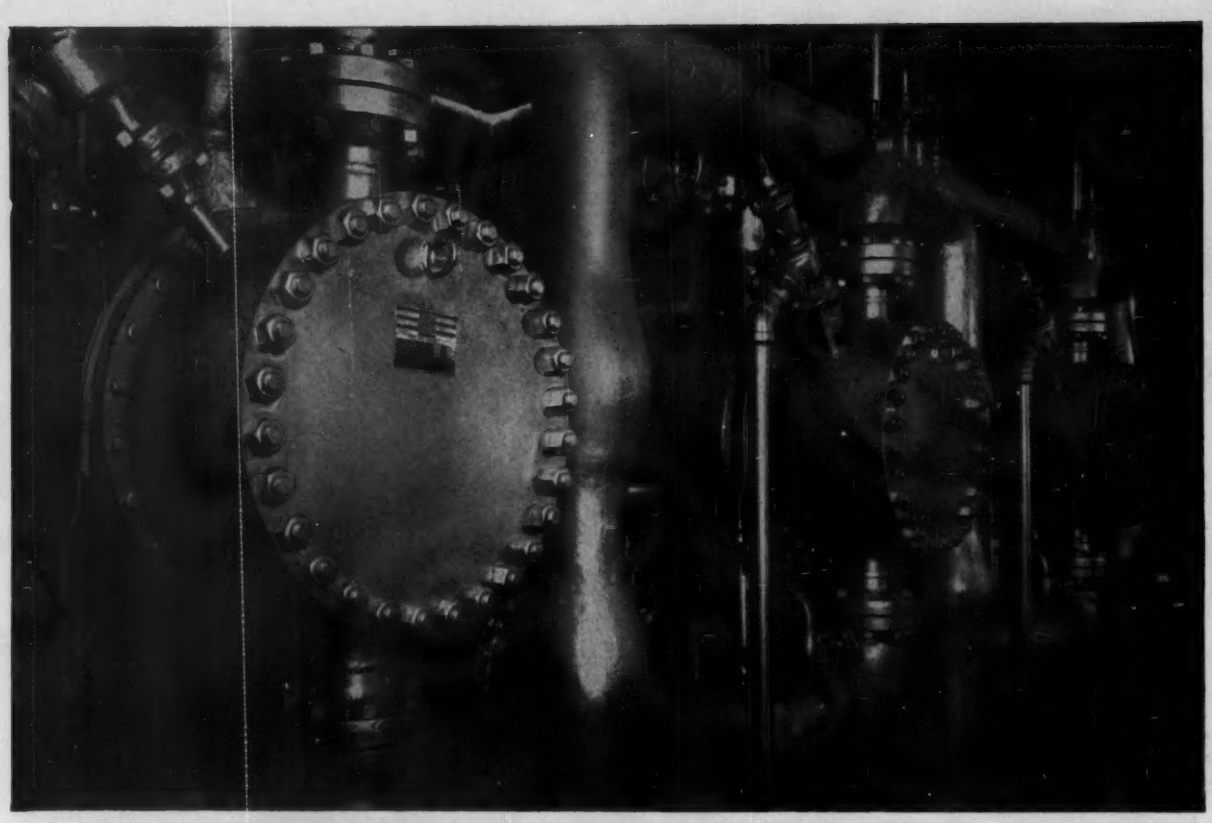
Deep in the interior of a giant cooling tower visibility is obscured by shadows, and haze that's actually cooling water, falling like rain down into the tower basin, where it's collected and recirculated to the condensers.

Keeping this water at optimum pH, when it collects in the basin, was once a difficult problem. But the application of practical engineering principles, resulting in the baffle-lined distributing trough and regulated reagent feed shown here, plus L&N's pH Controllability Analysis, offers a new and successful solution to this problem.

For it's here, *inside the tower*, that vital pH control can be most effective for slime control, scale prevention, wood protection, and conservation of make-up water.

We'll be glad to send you details on the "inside story" of tower pH. Write Leeds & Northrup Co., 4907 Stenton Ave., Phila. 44, Pa., for Process Data Sheet 700(1).

LEEDS LN NORTHRUP
instruments *automatic controls • furnaces*



THE ROSS STORY

Special Heat Exchange Equipment for Power Plants

Simply stated, Ross designs and manufactures heat exchangers for virtually all conditions and applications, particularly units of a highly specialized nature, such as high pressure power plant equipment...bleeder heaters and fuel oil heaters, for example.

The installation of 6 Ross High Pressure Fuel Oil Heaters (illustrated) at the Pacific Gas and Electric Co.'s Station P Steam Plant in San Francisco is typical. Featuring forged oil channels with integral tube sheets and a double tube sheet arrangement to insure against any possibility of fuel oil contaminating the steam system, these rugged units demonstrate Ross' resourcefulness and experience in dealing with both the average and the specialized power engineering problem.

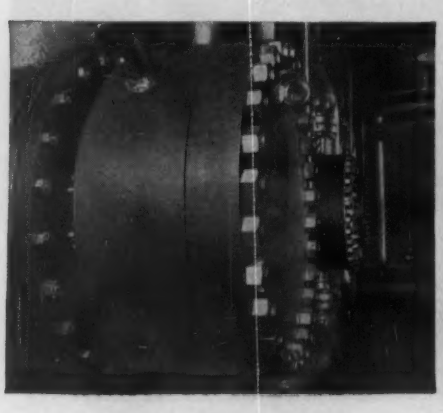
Your requirements, too, can be met with the same, exacting Ross attention to details. Inquire now. Ross offices are in all principal cities.

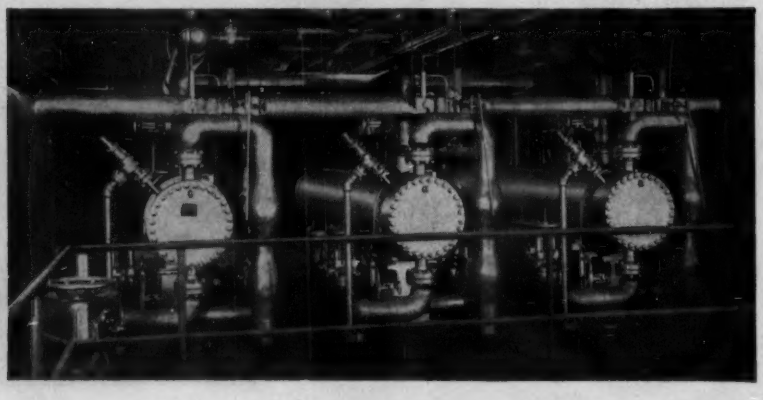
For recommendations on specialized heat exchangers, as well as on surface condensers, turbine oil coolers, engine oil and water coolers, compressor inter and after coolers and related power plant equipment, you'll profit by consulting a Ross engineer.

ROSS

ROSS HEAT EXCHANGER DIVISION
of
AMERICAN - Standard
BUFFALO 13, N. Y.

In Canada: American-Standard Products (Canada) Limited
Toronto 5, Ont.





Jones & Laughlin

Electric Resistance Welded

Pressure Tubing

QUALITY CONTROL—Jones & Laughlin, an integrated steel maker, controls every step of production from iron ore to finished tubing.

RIGID TESTING—most modern testing procedures, at every step of progress, assure maximum strength and safety standards. Users can be sure that every safeguard possible is used before a tube is certified to ASTM A178-55 or A214-55.

EASE OF FABRICATION—J&L pressure tubing can be fabricated according to your requirements.

For your next order, specify Jones & Laughlin pressure tubing for long life, maximum strength, clean appearance. Write for name of your nearest source.

Jones & Laughlin
STEEL CORPORATION · PITTSBURGH

here's how you "govern" the government

Much as we revere and respect this system of ours, we don't want the government running our lives.

The best government is one that's closest to the people. And there's just one way to keep it under control.

Vote.

Every time you get a chance.

Vote November 6, for sure.

Vote to elect the ones you want representing you. To keep the ones who are doing you proud. To get rid of the ones who are not so hot.

You're the boss, however you vote. No matter who's elected, you pay their salaries and paint their offices and keep watching over them as they work.

Even if the ones you're "agin" happen to win, they're obligated to the minority, too. They're servants of *all* the people, not just those who voted for them.

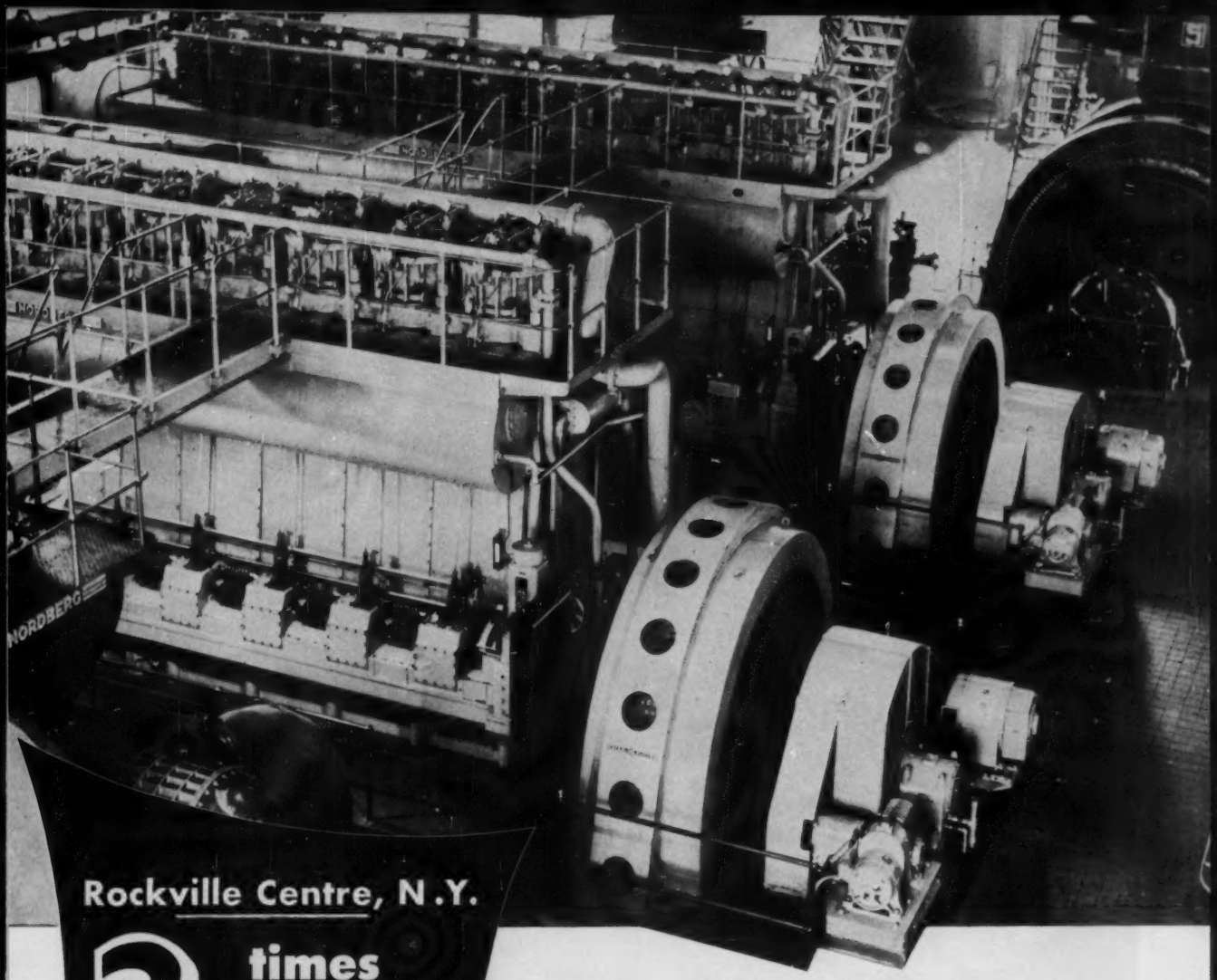
Your vote prods, approves, protests, demands, restrains, rewards.

Vote—so you and your children after you always can.

THE AMERICAN WAY OF LIFE MUST BE SAVED BY THE PEOPLE OF THE NATION

PUBLIC SERVICE ADVERTISING COUNCIL

See You at the POLLS!



Rockville Centre, N.Y.

3 times the power in the Same Space with NORDBERG DIESELS

Plant Reports Fuel Consumption of 14.77 KWH per gallon on NEW NORDBERG ENGINES

● Experience of the City of Rockville Centre, Long Island, N. Y., is evidence of the ability of Nordberg Diesels to meet increasing power requirements at low cost.

From their first small generator, installed in 1898, the present modern power plant has evolved . . . going from steam to diesel in 1927. By 1930, four diesels totaling 4600 hp occupied the entire original plant. These engines more than amortized themselves and are now gone. Today, four big Nordberg Diesels totaling 15,850 hp have replaced them in the Rockville Centre plant . . . *and occupy the same space as did the original four engines which produced only 4600 h.p*

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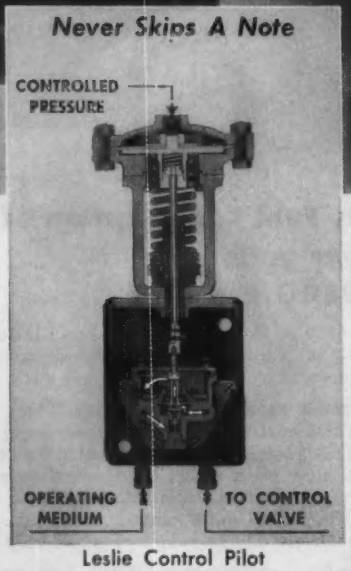

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THE SHORTAGE OF SCIENTISTS AND ENGINEERS:

What Caused It?

WHY is the United States confronted with a serious shortage of scientists and engineers?

One reason, discussed in earlier editorials in this series, is that the increasingly complex technology needed for national security and for an expanding economy has raised enormously the demand for technically trained people.

But it is clear also that too little has been done to increase the supply of scientists and engineers and to make most effective use of the limited number now available. It is with this second reason for the shortage that this editorial deals.

Too few bright young people have been attracted to careers in the sciences and engineering. Many with technical training have been leaving these professions, with the exodus from teaching being especially alarming. And the technical talent now employed in industry, government and education is, in too many instances, being utilized less effectively than it might be.

Paying for a Miscalculation

A legacy of the depression provides part of the explanation for the current shortage of young people entering scientific and engineering careers. Because of low birthrates in the 1930s, there are now about one million fewer boys and girls of college age than there were in the early 1940s. Not until 1960 will there be as many in the 18-21 age group as in 1945. And from the brightest young people of these ages must come, not only scientists and engineers, but the new members of all the professions needed by our growing economy.

A miscalculation in the late 1940s, when our future needs in various occupations were being gauged, provides another part of the explanation. Occupational counselors and high school students were advised that, because of heavy postwar enrollments in engineering and other technical fields, "it is likely that the shortages of trained men will be alleviated in a few years."*

Instead of being alleviated, however, the shortages became more acute. Job opportunities grew rapidly, while graduating classes dwindled. Fewer than half as many students received degrees in engineering in 1955 as in 1950, the peak postwar year. The trend has been reversed, but graduating classes will not be large enough to narrow the gap for several years.

Lost Talent

Beyond these temporary conditions, there is another explanation for the failure of the number of scientists and engineers to keep pace with our rising needs. This is the staggering loss between high school and college of young people with the talent to be successful in science and engineering. **Last year between 60,000 and 100,000 high school graduates of college ability failed to enroll in college for financial reasons and perhaps an additional 100,000 did not enter college because of lack of interest.†**

Of the most intelligent 20 percent in the group of college age, fewer than half enter college and only about a third graduate from college. Educational authorities estimate that fewer than 2 percent of those in the college age group who are mentally equipped to obtain Ph. D. degrees will actually obtain such degrees.

Another crucial stage is in the high

*U. S. Bureau of Labor Statistics, *Occupational Outlook Handbook* (Bulletin 940), p. 63.

†Charles C. Cole, Jr. (assistant dean, Columbia College, Columbia University), *Higher Education*, November 1955.

schools, where future scientists and engineers receive their first training in science and mathematics. There are serious weaknesses and signs of deterioration in this vital part of our educational system.

One-quarter of all American high schools offer no chemistry or physics. One-quarter offer no geometry. In many of the schools offering science and mathematics courses, the quality of instruction is low. Last year in the New York City school system alone more than 10,000 students were in science classes taught by teachers who were not trained in science.

This is a situation that threatens to become much worse. Between 1950 and 1955 the number of graduating teachers qualified to teach high school mathematics dropped 53 percent and those qualified to teach science dropped 59 percent. Furthermore, only about 60 percent of the graduates certified to teach mathematics or science in 1955 entered teaching as a career.

On the students' side — partly because of inadequate guidance programs — there has been a drift away from science and mathematics courses. The result of low student interest, and poor high school programs, in science and mathematics is virtually to foreclose careers in science and engineering to many bright young people. They miss the necessary basic training. Many who do attempt to obtain college training in these fields are ill-equipped. Engineering school deans report that fully half of their students enter with deficiencies in mathematics.

Misuse of Trained People

Scientific and engineering careers have long had a reputation for low salaries and limited opportunities for advancement. In recent years starting salaries have sky-rocketed and have been accorded wide publicity. But unfortunately there has been much less improvement in the salaries paid experienced engineers and scientists, especially in government and education. This has lowered the morale of experienced men and provided an incentive to desert engineering and research positions for higher paying jobs in sales or management.

Engineers and research scientists complain also that too much of their time now is spent on tasks that draftsmen and technicians could perform. Unfortunately for easy solution of this problem, however, there is an acute shortage of technicians as well. Worse still, there are indications that some companies in industries using large numbers of engineers have gobbled up technical manpower at a faster rate than they can effectively employ these scarce people.

Another drain on the supply of newly-trained scientists and engineers is military service. About 8,000 of this year's 27,000 engineering graduates were in ROTC programs and committed to active duty after graduation. Dr. A. W. Davison, chairman of the Engineering Manpower Commission of the Engineers Joint Council, says that in most cases no attempt is made by the Armed Services to assign these young officers to duties for which their engineering education specifically prepared them. They are not only withheld from industry and education for two years but also are not utilized in defense programs requiring more engineers and research scientists.

Some of the causes for the present shortage of scientists and engineers — bad advice a few years ago and a college age group held down by depression birthrates in the 1930s — are gradually being overcome. But others, such as the deterioration of science and mathematics training in our public schools and the many instances of ineffective utilization of scarce technical talent, enjoy no such prospect of automatic correction. The final editorial in this series will deal with some practical suggestions for meeting these problems.

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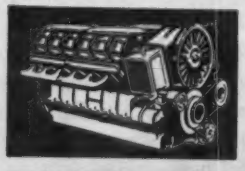

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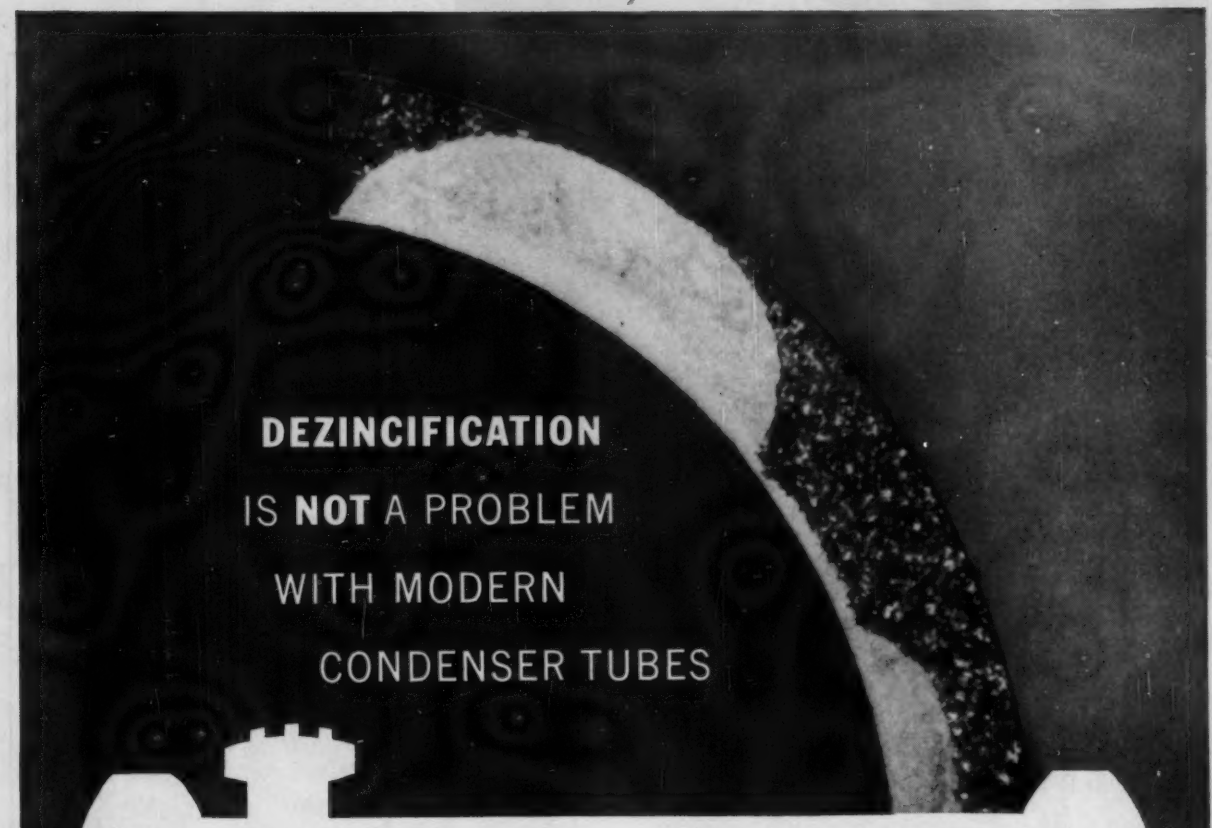

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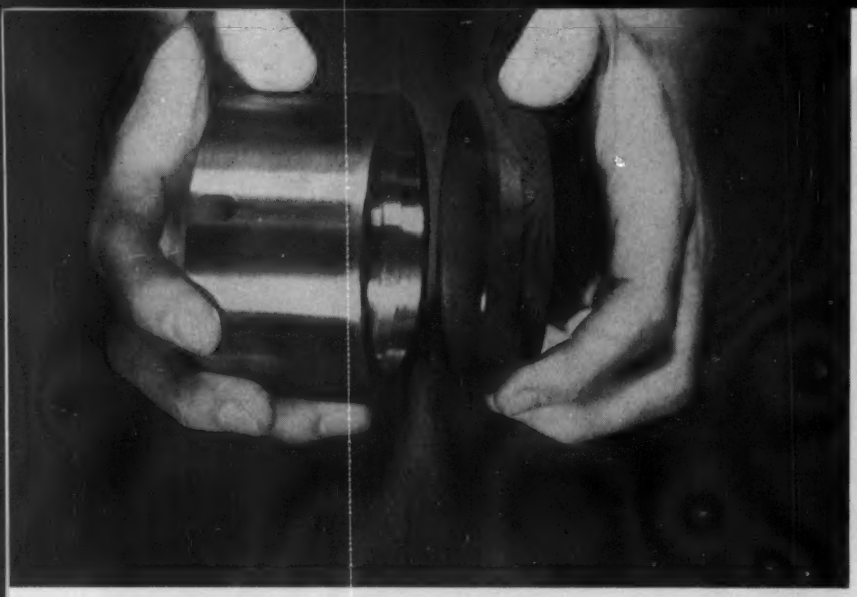

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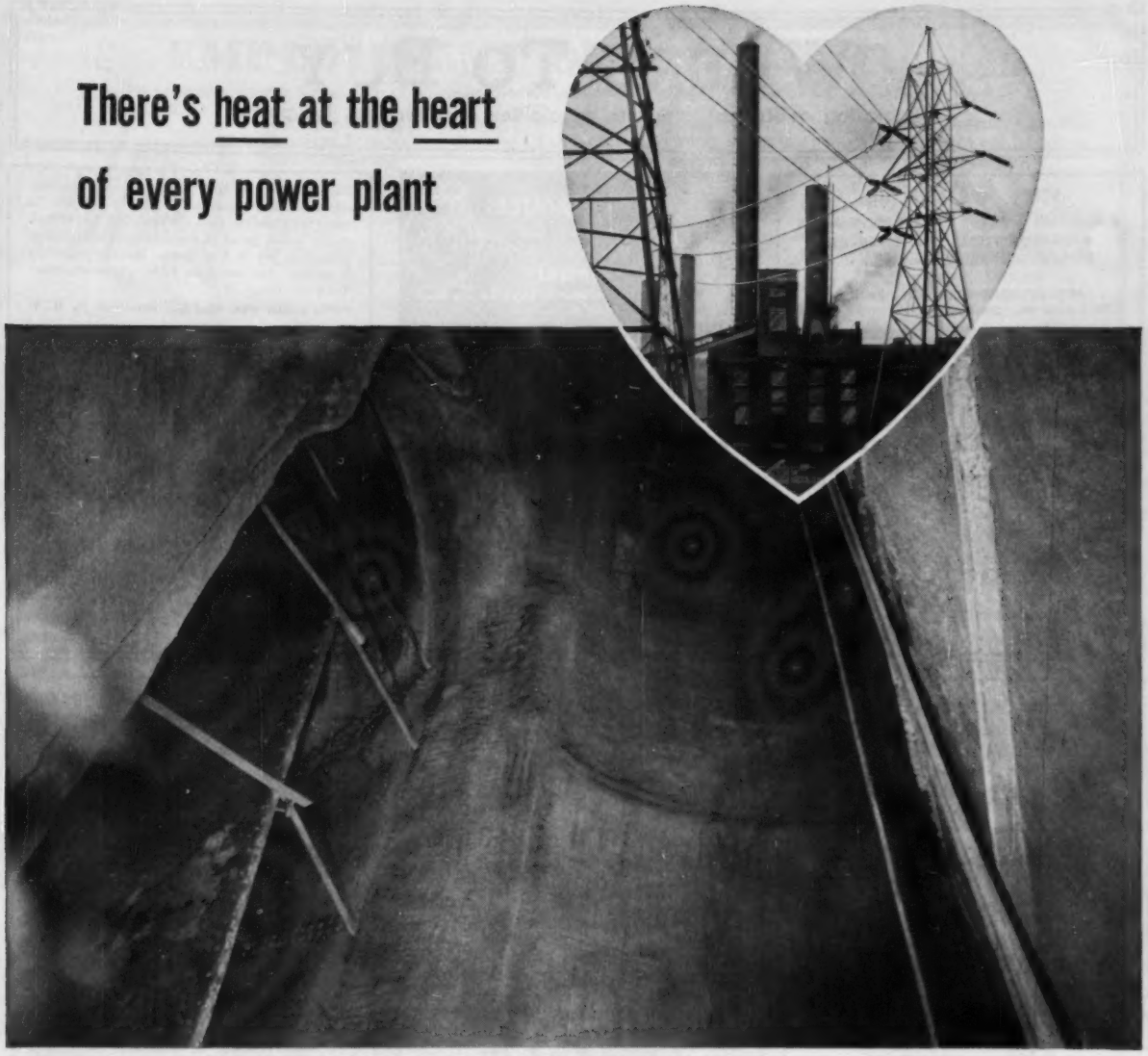

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Leeds & Northrup Co.

Has Attractive Offers Available For—

ELECTRICAL ENGINEERS

. . . with B.S. degree and at least 5 years' experience in Electrical power Controls and Operations.

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If you would like to work in our Application Engineering Department with responsibility for engineering proven components into control systems for solving new problems in the power field, then communicate with us soon.

These positions will require 25% of your time spent on field tests and problems analysis in the power industry. The remaining time will be spent in Philadelphia. These are permanent positions.

THE SALARY IS OPEN AND THERE IS OPPORTUNITY FOR ADVANCEMENT

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Offers you immediate long range engineering opportunity in

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Engineers, designers and draftsmen required with the following experience:

Electrical Sub-Station
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Liberal relocation allowances for you and your family.

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A large engineering and construction firm in Eastern Penna. is looking for a man who has been, or is now, engaged by an electric utility company in the capacity of senior or junior executive.

His primary duty will be that of contacting executives and officials in the Utility field to promote relations and solicit inquiries for engineering and construction services in connection with power plant expansion programs. Applicants should be free to travel and have high order of personal responsibility in work and client relationships. Salary open.

Write outlining personal history and work experience. Please include telephone number.

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Classified Adv. Div.
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POWER

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POWER ENGINEER

A unique career opportunity for a graduate mechanical engineer is now available in the Engineering Service Division of our Engineering Department. The applicant must have 8 to 10 years of practical power experience, including operation and maintenance of industrial steam power plant facilities and equipment testing. Some experience in steam plant design and construction or in thermal insulation of process piping and equipment is desirable.

The successful applicant will assist in specification of power equipment and in selection of new facilities, and will make economic evaluations and involved heat balances for complicated power systems. Duties will include determination of causes of equipment malfunctioning and development of recommendations for corrections.

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PEnnsylvania 6-5096

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You'll enjoy it. 4th Ed. Send $2.00 to

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Turbine suitable for 400 psig 700 deg. total temperature, extraction 16,000 pounds per hour minimum at 150 psig. final exhaust at 5 psig. As an alternate, this machine may be condensing with two extraction points of 150 and 5 psig. Electrical characteristics 480 volts 3 phase 60 cycles.

Address all proposals to

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400 KVA GASOLINE DRIVEN POWER PLANT

Stationary engine, circ. water cooled, Sterling Model TCS, 8 cyl., Ser. #054, 565 HP, 1200 RPM, direct conn. to:

AC Gen., W.H. SO67E264, 400 KVA, 480 V., 482 amps., 80% P.F., 3 ph., 60 cy., 1200 RPM, Ser. #4959815 w/direct conn. exciter and rheostats.

Units mounted on factory cast base, in good cond.—stand-by unit.

Factory advises unit can be converted to operate on natural gas, propane, or butane.

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Used hot well tank for returned condensate

2 Used returned condensate pumps

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World's Best Rebuilts

95 CFM	1500 PSI	6½-3⅞x1½x7	Chicago-TCB3
138 CFM	100 PSI	7x7	Ingersoll ESI
234 CFM	100 PSI	9x9x9	Chicago St. (new)
268 CFM	500 PSI	10-4½x10	Ingersoll XOB
343 CFM	500 PSI	11-5x13	Worth. (new frame)
464 CFM	100 PSI	12x11	Gardner RX
478 CFM	100 PSI	11½x7x7	Worthington YB2
552 CFM	100 PSI	13-8x12	Ingersoll XRB
593 CFM	100 PSI	13½-8x8	Ingersoll XRE2
676 CFM	100 PSI	15-9½x12	Ingersoll XRB
640 CFM	100 PSI	16-10x10	Pennsylvania DE2
877 CFM	100 PSI	17-10½x14	Ingersoll XRB
1665 CFM	42 PSI	16-16x10	Ingersoll XRE1
1723 CFM	110 PSI	140 lbs. at	Ingersoll XPV

Portables—Worthington 60 to 900 CFM

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B&W boilers sectional header type. Also fire tube boilers. Write to:

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Complete Switchboard Design & Construction
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1—1250 or 1500 KW Turbo Generator 400 PSI at Throttle, 700° F.TT—Extraction 150 PSI and 5 PSI balance run condensing.

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SAWMILL POWER PLANT • *ultra-modern throughout*

Each piece is a super-value . . . part of the top-quality equipment of Fischer Lumber Co., the West's Most Modern Sawmill . . . now liquidating—now offering you these tremendous values!

- 2—375 HP Garrett & Shafer Boilers 300 lbs.; Super Heaters 700° total.
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Rebuilt HEMPHILL Guaranteed EQUIPMENT

TRANSFORMERS—60 CYCLE

Qu	KVA	Make	Type	Phase	Voltages
2	750	G.E.	H	1	4600-120/240
1	750	G.E.	HT	3	4150Y-220/440
2	250	G.E.	H Pyranol	1	2400-4800/8320Y-120/240
2	250	West.		1	2300/4600-230/460
3	200	G.E.	H-KD	1	13800/12420/4600-240/480
3	200	G.E.	H	1	7800/15600-220/440
1	150	Kisler	OA	1	4160-240/480
3	50	Penn	OISC	1	2400/4160Y-240/480
3	50	G.E.	H	1	2400/4800-120/240
1	25	G.E.	H Pyranol	1	2400/4160Y-120/240
6	15	Maloney	KL	1	2400/4160Y-120/240

SYNCHRONOUS MOTORS

Qu	HP	Make	Speed	Type	Volts
1	100	G.E.	900	TS	2300
1	125	G.E.	600	TS	2300
1	125	E.M.	900		4800
1	150	G.E.	1800	TS	220/440
2	150	Allis-Ch.	360		2200
1	150	West.	900		220
1	300	E.M.	720	TEFC	2300
1	500	West.	450	HR	440
1	1000	West.	360	Mill	2300/4150

SLIP RING MOTORS

Qu	HP	Make	Speed	Type	Volts
1	15	G.E.	900	MT-542	440
1	25	G.E.	900	MT-526	440
1	60	G.E.	1800	MT	220
1	60	Ideal	900	AV	220
1	75	G.E.	600	IM	440
3	150	Allis-Ch.	1800	AY RW	2300
1	200	West.	514	CW	440
1	250	West.	600	CW	440
1	350	West.	1800	CW	2300
1	500	G.E.	1200	M	2400/4150

SQUIRREL CAGE

Qu	HP	Make	Speed	Type	Volts
1	75	G.E.	1800	K-4458	440
1	100	West.	1160	CS	440
1	100	L-Allis	1770	RX.T.E.F.C.	440
1	150	G.E.	720	KT-562	440
2	250	G.E.	1790	K.-T.E.F.C.	2300
1	275	G.E.	1200	KT559BS	2200

MOTOR GENERATOR SETS

Qu	K.W.	Make	Speed	Volts DC	Volts AC
1	10	G.E.	1800	125	220/440 V.
1	30	G.E.	1800	125	220/440 V.
3	60	E.M.	1200	125	220 v. Syn.
1	75	G.E.	1800	250	480 v. S.C.
1	150	CR. Wh.	900	125	220/440
1	300	G.E.	1200	250	2300/4160Y S.R.
1	1000	West.	720	600	2300/4160Y

D.C. 230 VOLT MOTORS

Qu	HP	Make	Speed	Type
1	30	G.E.	1650/1800	CDM 85
3	30	C.W.	700	CM
1	25	G.E.	800	RC
2	75	C.W.	900	WP
1	125	G.E.	1700	RC
2	150	C.W.	900	WP
1	250	Allis Ch.	1750	EBL149 BB

A.C. HOIST MOTORS

Qu	HP	Make	Type	Speed	Volts
1	35	G.E.	MTC	585	440
2	300	G.E.	ITC-5017	600	440

FOR POWER
J.L. HEMPHILL & CO.
603 58th STREET, NORTH BERGEN, N. J.

NEW 25 CYCLE — MOTORS AT LONG DISCOUNTS

Qu.	HP	Make	Phase	Volts	Brg.	Frame	RPM
16	¾	Wag.	1	110/220	SL	48X	1425
9	¾	Wag.	1	110/220	SL	48X	1425
10	¾	Whse.	3	220/440	SL	145	1425
8	¾	Whse.	3	220/440	SL	186	1425
3	¾	Whse.	3	550	BB	186	1425
3	¾	G.E.	3	220	SL	TT	1425
2	1	L.A.splash	3	550	BB	224	1450
5	1	Whse.	3	220/440	SL	FX224	1450
7	2	L.A.splash	3	550	BB	FX225	1450
5	3	L.A.splash	3	550	BB	FX254	1450
1	5	L.A.splash	3	550	BB	FX284	1450
3	10	L.A. XP	3	220/440		JEX364	1450
1	15	G.E. used	3	220/440		365	1450
1	25	Rel. XP	3	220/440		405	1450

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80—1½ KVA, Line Material, Dry tpe, 120/240/480 volt primary to 120/240 volt secondary with taps. 1 phase, 60 cycle

3—250 KVA, General Electric, OISC, 2300 volt primary, 460/230/115 volt secondary, 1 phase, 60 cycle

6—600 KVA, Westinghouse, OISC, 2300 volt primary, 460/230 volt secondary, 1 phase, 60 cycle

BENSON-WILIMZIG, INC.
1704 N. 8th St., St. Louis 6, Mo.
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20" DREDGE BOOSTER PUMP

11870 GPM at 245' head, for mud or sand. Driven by a 1500 HP slip ring motor.

Will sell pump or motor separately.

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SPECIAL OFFERINGS

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1—1000 KW—240 volts—130/250# Condensing Auto. Extraction—15#—New 1945

1—1000 KW 480 volts—225# Condensing Auto. Extraction—20#

1— 400 KW—550 volts—400# Condensing Auto. Extraction—20/50# New 1948

1— 300 KW—480 volts—210# Condensing Auto. Extraction—40#

1— 250 KW—240 volts—130#—Non-Cond. 10/12# Back pressure

TRANSFORMERS

3— 8,333 KVA—66,000/38,000/11,900/6800 volts

3— 500 KVA—2300/550 Volts (New 1948)

1— 450 KVA—13,800/208 Volts—3 ph.—(network)

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1—120,000# Deaerating Heater—Tray Type

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THE BUYERS MUST BE SATISFIED—ALWAYS

BARGAIN TRANSFORMERS

2—600 KVA, General Electric, 3 ph, 60 cy. 6900/11950Y/13800 x 230/460 volts

3—500 KVA, Westgh. 2400 x 480 volts

6—250 KVA, Westgh. 2400 x 240/120 volts

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(2)—manufactured by The Parkersburg Rig And Reel Co. Type "S"—size 32"—15 PSI—720 RPM—4000 HP—5" shaft diameter.

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Whse. late type, outdoor type, De-Ion Grid, T.P.S.T., Rated 161000 V., 1200 amps., 60 cy., 3 ph., Type GO-3, Interr. Duty 1,500,000 KVA.

Fully complete—Cond. like new.

Price and further inf. upon request.

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ROTARY CONVERTERS

2—1500 KW—G.E. Synchronous (Steel Frame), type HCC, form P, Serials 5227022 and 24, volts DC 600; AC end 3/60/440/720 RPM. With: 2-sets of 3—525 KVA—G.E. transformers, type ABJ, form F, 1 ph., 60 cy., 13800/445 volts, Air Press. 1 oz.

Complete on original foundation. Priced low, before removal.

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CAPACITY EACH — 60,000 LBS. STEAM PER HOUR

Manufactured by Foster Wheeler for the U. S. Navy. Two of these powered a Destroyer Escort Vessel. They can be outfitted for seagoing vessels; or are adaptable for industrial use where high temperatures and pressures are required.

New, never used, never erected. Stored indoors. 2 drum, 435 psi operating pressure, 740 deg. F. final steam temp., with superheater, economizer, fuel oil burners, soot blowers, valves and fittings. All accessories by well known manufacturers.

A tremendous buy over new manufacturers prices. Located at Utica, New York. Inspection and inquiries invited.

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500' Sections of 42" Belt Conveyors
50-100 & 160 HP Package Type Boilers
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12,000 Gal. ¼" Oil Storage Tank
8" Slurry & 10x10 Centrifugal Pumps

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BOILERS

TWO BABCOCK & WILCOX 1650 sf each 250 psi Bigelow Liptack arch, oil and P.F. firing, all auxiliaries, in excellent condition. Offers invited.

ARNOLD, HOFFMAN & CO., INC.
DIGHTON, MASSACHUSETTS

SPECIALS

5000 KVA TURBO GENERATOR, condensing, 450 PSI.

200 KW MG SET, 250 Volts DC, 2300/3/60.

6300 sq. ft. CONDENSER.

700 HP Ideal Synch. MOTOR 4150/2400 514 RPM & panel.

628 CFM ES1 I.R. COMPRESSOR 100 PSI.

BOILERS

150 HP UNION WATER TUBE, 160 PSI.

250 HP B&W, 150 PSI.

4' x 135' STEEL STACKS.

70,000 LB. HEINE, 400 PSI.

80,000 LB. ERIE, 250 PSI.

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Murray Hill 7-5280

(Machinery & Equipment Merchants)

TURBO-GENERATORS

2500 KW G.E. Non-C. 3/60/2400/4160 V 3600 RPM 185 PSIG 30‡ BP

2000 KW Allis, Cond. 3/60/2400 V. 3600 RPM 400 PSIG 600‡ TT

1000 KW G.E. Cond. Extr. 3/60/480 V 3600 RPM 225 PSIG 20‡ extr.

Full line power equipment

BREW, WOLTMAN & CO., INC.

50 Church St., New York 7, New York

Thousands of Motors & Generators IN STOCK.

EVERY MACHINE COVERED BY THE WAGNER GUARANTEE

D. C. MOTORS

HP	Mfr.	Type	Volts	Speed
300	Allis Ch. b.b.	EW	250	1000
200	Reliance	1400-T	230	850
175	Cr. Wh.	151-H	230	500
150	Whse.	SK-184	230	850
100	Reliance	651-T	550	1800/1600
100	Reliance	651-T	230	575/1150
75	F. Morse b.b.	DH-140	115	1600
65	Cr. Wh.	CMC	230	575/1100
60	Allis Ch.	E-146	230	1150
50	G.E. (2)	CD-125	230	400/1200
50	G.E. b.b.	CD-93		3500
40	Reliance b.b.	131-T	550	1750
30	Imperial b.b.	D-69	230	400/1600

MOTOR-GENERATOR SETS

KW	Mfr.	Input V	Output V.
300	Gen. Elec.	2200/440 AC	260 DC
250	Allis Ch.	2200/440 AC	350 DC
200	Whse.*	220/440 AC	55 DC
200	Gen. Elec.*	220/440 AC	125 DC
175	Gen. Elec.	220/440 AC	250 DC
125	Gen. Elec.*	2300/4000 AC	250 DC
100	G.E.*	2200/440 AC	125 DC
100	Whse.	220/440 AC	250 DC
75	G.E. converter	440 AC	250 DC
75	Cr. Wheeler	25 cycle	125 DC
75	Whse.	2200/440 AC	600 DC
60	Whse.	220/440 AC	250 DC
50	Gen. Elec.	220/440 AC	125 DC
25	Gen. Elec.	220/440 AC	125/250 DC

D. C. GENERATORS

KW	Mfr.	Type	Volts	Speed
300	G.E. (2)	CY-275	260	1200
250	Allis Ch. b.b.	EW	350	1200
200	Reliance	1400-T	250	1200
150	Whse.	SK-184	250	1150
150	Cr. Wh.	CCD	250	650
100	Whse.	SK-180	250	900
100	Allis Ch.	E	125	1200
100	Reliance	651-T	600	1200
75	Whse. b.b.	SK-168	125	1000
60	Allis Ch. (2)	E-146	250	1500
40	Gen. Elec.	HC	250	1750

A. C. MOTORS — 60 CYCLE

HP	Mfr.	Type	Volts	Speed
700	G.E.	Slipring	220/440	1800
700	Allis Ch.	Sq. Cage	440	900
600	G.E.	Slipring	2300	600
500	Whse.	Slipring	2200	450
500	G.E.	Sq. Cage	4000	1800
450	Allis Ch.	Synch.	480	400
400	Whse. (2)	Synch.	2200	1800
400	Whse.	Sq. Cage	2200	514
400	Marathon (2)	Sq. Cage	2200	3600
350	G.E.	Sq. Cage	2200	1800
300	G.E.	Sq. Cage	440	1200
300	El. Mchy. (2)	Synch.	2200/440	360
300	G.E.	Slipring	2200/440	600
300	Whse.	Synch.	440	1200
300	G.E.	Slipring	440	450
250	G.E.	Slipring	440	1800
250	G.E.	Sq. Cage	2200/440	1200
250	Gen. Elec.	Sq. Cage	440	3600
250	G.E.	Slipring	220/440	720
250	Gen. Elec.	Synch.	220/440	450
250	G.E.	Synch.	220/440	720
225	G.E.	Synch.	220/440	900
200	G.E. b.b.	Sq. Cage	2200/440	1200
200	Whse. (2)	Slipring	2200	514
200	Reliance b.b.	Sq. Cage	220/440	1800
200	Allis Ch.	Slipring	440	450
200	Gen. Elec.	Sq. Cage	220/440	720
200	Cr. Wh.	Sq. Cage	220/440	3600
200	Whse.	Sq. Cage	2200/440	900
200	E.M.	Synch.	220/440	1200
175	G.E. (2)	Synch.	220/440	720
150	El. Machy.	Synch.	220/440	360
150	G.E. (4)	Slipring	2200/440	600
150	G.E. (2)	Sq. Cage	2200/440	720
125	Whse. TEFC	Sq. Cage	2200/440	720
125	Gen. Elec	Slipring	440	600
125	G.E. TEFC	Sq. Cage	220/440	3600
125	Ideal	Slipring	4000/2200	900
100	Whse. TEFC	Sq. Cage	220/440	1200
100	Whse (2)	Sq. Cage	2200	900
125	G.E.	Slipring	220/440	450

Buy now from this tremendous stock of excellent machines... AC & DC... all sizes and types up to 1000 H.P.

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2–768 C.F.M. *(Actual)* FULLER 2-STAGE ROTARY AIR COMPRESSORS – NEW 1953

Size C-150-150H 100 lbs. pressure

Direct Synchronous Motor Driven with regulators, intercoolers, air-maze filter, silencer, Manzel mechanical lubricators, aftercoolers, essential piping, valves, air receiver.

Motor Control: GE Limitamp Synchronous motor starters, 400 amp ITE 5 KV interruptive switch.

IMMEDIATE SHIPMENT

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144 Grand St. Phone CAnal 6-6976 New York 13, N. Y.

–TRANSFORMERS–

BOUGHT AND SOLD

We carry a large stock of rebuilt and guaranteed transformers, and invite your inquiries.

Custom-built transformers and coils manufactured to your specifications.

Expert Repair Service—all makes and sizes of transformers rewound, repaired and redesigned. Ask for our price schedule.

THE ELECTRIC SERVICE CO., INC.

5318 Hetzel St. Cincinnati 27, Ohio

40 Years' Dependable Service

BELYEA RE-NU-BILT
LARGE ELEC. POWER EQUIPMENT
SELECTED STOCK ITEMS

RE-NU-BILT—GUARANTEED—RE-NU-BILT
COMBINATION MILL DRIVES — 15/2500 HP
D.C. MOTORS WITH M.G. SETS & CONTROLS

Qu.		MAKE	TYPE	VOLTS	R.P.M.
1—	2200 HP	G.E.	MCP-12	600	400/500
	2200KW	G.E.	Syn.	2300/4600	514
1—	1250 HP	G.E.	MCF	600	600/750
	1000 KW	G.E.	Syn.	2300/4600	720
1—	1000 HP	G.E.	MCF-8	600	350/700
	1000 KW	G.E.	Syn.	2300/4160	720
1—	200 HP	G.E.	CD-1650Z	250	500/1500
	200 KW	Whse.	Syn.	440	1200

ALSO MANY OTHER COMBINATIONS

A. C. MOTORS—3 Ph. 60 Cy.

SLIP RING

Qu.	H.P.	Make	Type	Volts	Speed
1	1500	G.E.	MT	6600	257
1	1500	G.E.	MT	6900	1187
1	1100	G.E.	IM	2300	720
1	1000	A.C.	Mill	2300	240
1	800	G.E.	MT	2300	293
1	750	G.E.	MT-573	2200	1190
1	700	Al. Ch.	D.P.	2300	500
1	500	Whse.	CW	550	350
1	400	Whse.	CW-960A	440	1176
1	400	Whse.	CW	440	514
1	400	Whse.	CW-1218	2200	435
1	350	G.E.	IM-17A	440/2200	720
1	250	G.E.	MT-424Y	4000	257
1	250	A.C.		550	600
1	200	G.E	IM	2200	580
1	150	Whse.	CW30E17	2300	435
2	125	A.C.	ANY	440	865

SQUIRREL CAGE

1	800	G.E.	KT-573	2200	1180
2	650	G.E.	FT-559BY	440	3570
2	450	Whse.	CS-1420	2300/4150	354
1	400	G.E.	IE-15B	2300	1165
1	400	G.E.	IK	2200	580
1	200	G.E.	IK-17	440	580
3	200	G.E.	KT-557	440	1800
1	150	Whse.	CB	440	580

SYNCHRONOUS

1	7000	GE	ATI	2240/6600	600
1	4350	C.W	3501-8L	13800/6900	514
2	1750	G.E.	ATI	2300	3600
1	1750	G.E.	TS	2300	900
2	2000	Whse.		2300	120
1	1100	G.E.	ATI	2300/4600	900
2	500	G.E.	TS-756Y	2300	1200
1	450	Whse.		2300	450

M-G SETS—3 PH. 60 CY.

Qu.	K.W.	Make	RPM	DC Volts	AC Volts
1	3000(3U)	G.E.	514	600	4000/6600/13200
2	2000/2400	G.E.	450	250/300	2300/4600
1	2000	G.E.	500-25cg	600	11000
2	2000	G.E.	514	600	4600/2300
1	1750/2100	G.E.	514	250/300	4800/2400
1	1500	G.E.	720	600	6600/13200
1	1500	G.E.	514	250	2300/4600
1	1250	Whse.	720	600	2300
1	1000	G.E.	900	300	6600
1	750	Whse.	900	250	2300/4150
1	750	G.E.	720	125/250	2300/4600
1	500	Whse.	900	125/250	440
1	150	Whse.	1200	600	2300
1	150	Whse.	1200	275	2300

WELDING M.G. SET

Gen. Elec.—1100 Kva—0.7 p.f.—2300/4600 V. 3/60 Generator with 1750 Kva—.8 p.f.—2300 V. 3/60 motor complete with exciter set and controls.

TRANSFORMERS

Qu.	KVA	Make	Type	Ph.	Voltages
1	3000	A.C.	OISC	3	33000x2400/4160
1	2500	Al.Ch.	OISC	3	34500x13800
1	2500	Al.Ch.	Fur.	3	13800x14f/113
3	500	Kuhl	OISC	1	13800x6900
3	333	G.E.	HS	1	7200x2400x4160Y
3	333	G.E.	HSWR	1	2300/4000x230/460
3	333	G.E.	HD	1	13200x2530x4850Y
3	200	Whse.	OISC	1	13200x120/240

FREQUENCY CHANGER SETS

Qu.	KW	Make	Freq.	Voltages
1	5000	G.E.	60/50/60	6600/11000/6600
2	2500	G.E.	25/62.5	2300/2300
1	1000	G.E.	25/50.3	4400/2300
1	500	Al. Ch.	25/60	11000/2300

TURBO GENERATORS

Qu.	KW	Make	Desc.
1	4000	G.E.	Condensing 425 — 750 F.T.T. Surface Condenser 3/60/2300/4000 V Direct con exciter.
1	1500	Whse.	Auto extraction 190 lbs. — 660° F.T.T. 60 lb. extraction 3/60/240 V. Div. conn. Exc.
1	1000	Moore	Auto-Ext. Cond 175/200# U.S.P. 5/20# G. Ext. Surface Condenser—3/60/2300. Non-condensing 175/200 lbs. I.S.P. 5/20 lbs. G.B.P., 480/3/60.

BELYEA COMPANY, INC.
43 Howell St., Jersey City 6, N. J.

1—2500-KVA., WEST., 400#, 750° FTT., 28" VACUUM, GENERATOR, 3/60/2300-V.
Complete in every respect

1—1875-KVA., G.E., 440#, 750°FTT, 28" VACUUM, 3/60/2300-V.
Excellent Condition and Complete
Both Priced Right.

CHARLES WEAVER
19701 James Couzens Highway **Detroit 35, Michigan**

FOR SALE
DIESEL GENERATOR SETS
A.C. SETS

(3) 200 KW G.M. model 8-268A—8 cyl.—air starting—6½ x 7—heat exchanger cooled—driving Westinghouse generator—200 KW 440/3/60—1200 RPM—with direct connected exciter and complete with panel board for generator, engine starting air compressor and starting air tanks. Reconditioned by U.S. Navy. Units in excellent condition. Price on request.

(40) NEW AND TEST RUN ONLY—BUILT 1953 20 KW—120/208—3 phase 60 cycle 1800 RPM 4-wire ball-bearing E.M. generators with voltage regulator. Excitation 0.75 KW—62.5 volts —12 amps. ENGINE: Sheppard Model 6D—4½ x 5—3 cyl.—radiator cooled—212.8 cu. inch displacement—self-contained fuel tank—steel I-Beam base—12 volt heavy duty starter. Full generator rating 5000 to 8000 ft. Above 8000 ft., loss of 3% per 1000 ft. BARGAIN PRICE $2095.00 EACH!

THE BOSTON METALS CO.
313 E. BALTIMORE STREET
Baltimore 2, Md.—Lexington 9-1900

FOR SALE
18 NEW TURBINES

4 horizontal, 14 vertical, Westinghouse

Driving forced draft blowers—capacities ranging from 39000 to 56000 CFM and 16" to 24" pressure. Steam pressures 360 to 575#, back pressure 10#.

Will sell turbines separately if desired. *Price reasonable.*

Also—1—250 KW GE turbo generator unit, 3 phase, 60 cycle, 440 volt. Used one year.

G. M. DeROSE
2457 WOODWARD AVE.
408 DONOVAN BLDG.
DETROIT 1, MICH.

Available Immediately
NEW ELECTRIC MOTORS, CONTROLS, TRANSFORMERS
Cash for your surplus new motors
AJAX ELECTRIC MOTOR CO.
61 Curlew St., Rochester, N. Y.

LIQUIDATION COMPRESSORS
LAWRENCEBURG, INDIANA

6—I. R. type E-S-1 single stage air compressors 13" x 14", approx. 500 cfm each with 100 H. P. motors, air receivers, and aftercoolers.

2—I. R. type XOB air compressors 12½" x 12½" x 12" duplex, 100 psi, approx. 950 cfm each with 200 H.P. motors, air receivers and aftercoolers.

Priced for Immediate Removal
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BRILL EQUIPMENT COMPANY
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Texas Office: 4101 San Jacinto St., Houston

DIESEL ELECTRIC GENERATORS
TURBO GENERATORS
BOILERS
BOUGHT—SOLD
MACHINERY EXPEDITERS
170 Broadway, New York 38, N. Y.
OUR FIFTEENTH YEAR

BOILERS
HI-PRESSURE
Complete stock from 10-2,000 h.p.
Nation's largest inventory. New & Used.
WABASH POWER EQUIPMENT
31 E. CONGRESS, CHICAGO 5, HA 7-4855

DIESEL GENERATOR SETS

2—McIntosh-Seymour (Alco) 950 HP 8 cyl. 225 RPM, 875 KVA Westinghouse 3 phase, 25 or 60 cycle alternators. 20 KW exciters.

1—McIntosh-Seymour (Alco) 600 HP 5 cyl. 225 RPM, 500 KVA General Electric 3 phase, 25 or 60 cycle alternator. 15 KW exciter.

Complete plant installation with all accessories. Priced attractively. With or without generators.

MISSISSIPPI VALLEY EQUIPMENT CO.
507 Locust St. • St. Louis 1, Mo.

"SEARCHLIGHT" Can Help You!

Hundreds of miscellaneous business problems that confront you from time to time, can be solved through the use of the SEARCHLIGHT SECTION of POWER.

When you want to buy or sell used or surplus new Power equipment and/or accessories, or have other business wants — advertise them in the SEARCHLIGHT SECTION for quick, profitable results!

GUARANTEED REBUILT POWER EQUIPMENT

SLIP RING MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2300 Volts or Higher)

H.P.	MAKE	TYPE	SPEED
2000	*G.E.	MT	600
1500	*Westg.	CW	600
1200	*Al-Ch	ANT	1800
1000	*Westg.	CW	450
700	*Al-Ch	ANY	720
600	*G.E.	MT	450
500	Westg.	CW	600
500	Westg.	CW	350
300	G.E.	IM-17B	600
250	*G.E.	I-M	450
200	Westg.	CW	900
200	G.E.	IM	600
200	Westg.	CW	514
200	Westg.	*CW-950A	514
150	Cr-Wh	50-R	1800
150	G.E.	MT-549	1800
150	*Wagner	RS-131	900
150	Westg.	CW	450
125	G.E.	IM-15A	600
100	G.E.	IM-13A	1800
100	G.E.	MTC-5546	900
100	G.E.	I-M	720
100	G.E.	IM	600
100	G.E.	IM-15A	450
75	G.E.	MT-347	1200
75	G.E.	IM	1200
75	Al-Ch	ARY-223C	1200
75	G.E.	MT-356	900
75	Al-Ch	ANY-26F	900
75	Al-Ch	ARY	720
75	G.E.	IM	900
60	Al-Ch	ARY	1200
60	G.E.	MT-546	1200
60	G.E.	*MT-536	1200
60	*Westg.	CW-762C	900
50	*Al-Ch	ARY-220-8S	1800

SLIP RING MOTORS

Crane & Hoist Service
3 Phase, 60 Cycle, 220 or 440 Volts

H.P.	MAKE	TYPE	SPEED
80	G.E.	MTC-5552	600
75	Westg.	CI-756A	600
50	Westg.	MW-334	600
50	G.E.	HIC-TENV	600
35	G.E.	MTC-5536	600
20	Westg.	CI	1200
11	Westg.	CI-E464	900
10	P & H	BW-6	1800
5	P & H	BW-6	1200
5	N. West.	WRC	1200
3	G.E.	MTC-5944	900

PUNCH PRESS MOTORS

NEW—3/60/220-440 volt
High Torque—Hi Slip

H.P.	MAKE	TYPE	SPEED
75	Fr. Morse	QFZK	1065
60	Westg.	CS-752C	1060
40	Reliance	AA-B-505	1635
30	L-Allis	CK-445	1080
30	Wagner	RP-444	1080
25	Reliance	AA-C-504	1100

PLATERS

AMPS	MAKE	VOLTS
7500/3750	El. Prod.	6/12-220/440
2000/1000	Chandy.	6/12-220/440
1500/750	Chandy.	12/24-220/440
1500/750	Chandy.	6/12-220/440
1000/500	Chandy.	12/24-220/440

SQUIRREL CAGE MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2300 Volts or Higher)

H.P.	MAKE	TYPE	SPEED
1250	*Al-Ch	ANX	3600
1200	*Al-Ch	ARW	1200
750	*Westg.	CS	900
500	*Al-Ch	ARW	3600
500	*G.E.	KT569S	900
500	G.E.	KT-424	450
400	G.E.	KT-424	720
250	Westg.	CS-Tefc	1800
250	G.E.	KT-559	1800
250	*L-Allis	OEX-148	720
250	*G.E.	IK	600
250	G.E.	IK-17A	600
250	Westg.	CS-14	514
200	*G.E.	FT-549Y	3600
200	*G.E.	IK-13B	1800
200	G.E.	KT-564	900
200	Al-Ch	ARWWT	600
150	G.E.	IE-13B	1200
150	*Al-Ch	AN-30F	1200
150	G.E.	IK	900
150	*Westg.	CS	600
125	*Westg.	CS-771 Sppf	1800
125	*Al-Ch	AR	1800
125	Al-Ch	AR-226 CS	1800
125	*Reliance	AA 6085	900
100	Westg.	CS 507S TEFC	3600
100	*Westg.	CS	1800
100	*G.E.	FT-542Z	1800
100	G.E.	FTRP-543	1800
100	*Westg.	CS-760D	1200
100	G.E.	KT-553	1200
100	G.E.	IK	1200
100	Al-Ch	AW-230	1200
75	Al-Ch	KF-445S	3600
75	G.E.	KF-445Z	3600

D. C. MOTORS

H.P.	MAKE	TYPE	SPEED
250	Westg.	SK-220	450/900
200	Westg.	SK-201	650
200	Cr. Wh.	CM	500
175	G.E.	ELC	750
100	G.E.	MPC	400/800
100	G.E.	RC-34	2500
100	G.E.	RC-19	575
100/150	G.E.	MCF	380/1000
50	Cr. Wh.	CMC	700/1100
50	G.E.	DLC-284	850
35	Westg.	SK-150	350/1000
30	Cr. Wh.	CCM-504	450
30/40	G.E.	CD-113	500/1500
25	G.E.	RC-32	800
25	Westg.	SK-133	575
20/25	Westg.	SK-151L	250/1000
20	Star	SB-10	1750
15	Westg.	SK-103	400/1600

M.G. SETS

K.W.	MAKE	A.C.	D.C.
1250	Westg.	6600/4160	600
1000	G.E.	12,000	600
500	Westg.	2300	275
300	Westg.	2300/440	250
400	A.C.	2300	120/240
200	G.E.	2300	250/275
200	Westg.	2300/4000	250/275
200	Ridgeway	2300	250
170	G.E.	220	125
150	G.E.	2300	125/250
150	A.C.	2300	275
150	Westg.	2300	125/250
150	G.E.	440	275
125	Cr.Wh.	4160	125
100	G.E.	2300	250
100	Al-Ch	2300	250
100	El.Mch.	440	125

CHICAGO *Electric Co.* 1320 WEST CERMAK RD, CHICAGO 8, ILL.

BOILER FEED PUMPS

STEAM TURBINE DRIVEN

GPM	TFH	Stage	Mfg.
450	802	4	Worth. (2)
500	850	4	Worth.
200	1375	6	Ingersoll R. (2)
200	950	2	Weinman (2)
190	1320	4	De Laval
750	725	4	Worth. (2)

MOTOR DRIVEN

GPM	TFH	Stage	Mfg.
740	2250	5	Worth.
700	1550	6	Worth.
675	1100	5	LeCourtenay
500	1050	5	Worth. (3)
100	1150	5	Gould

UNDERWRITERS FIRE PUMP

GPM	TFH	Stage	Mfg.
1500	231	1 (motor driven)	Fairbanks
750	231	(gas. driven)	Allis Chal. (2)

MOTOR DRIVEN SAND PUMPS

American Manganese 10"
Allen-Shaffer-Hoff 14"

NASH HYTOR COMPRESSORS

(4) size #2, 850 R.P.M., 10# pressure, 240 C.F.M.; 880 R.P.M., 180 C.F.M., when used as a Vacuum Pump.

2—2800 Gal. cap. 100# steam press. hot water storage heaters, mfg. by Quaker City Iron Works. Good shape.

This is only a partial listing of pumps carried in stock. We have hundreds of other pumps, compressors, and power equipment. Don't ask us what we have, write and tell us what you want.

PHILADELPHIA TRANSFORMER CO.
Box 566 Dalton, Pa.

37 Years Dependable Service

SLIP RING MOTORS 3-Ph., 60 Cy.

H.P.	Volts	Make	Speed
800	2300	Whse.	900
500	4000/2300	G.E.	600
450	440	Whse.	514
400(2)	2300	G.E.	900
300	2200/440	G.E.	720
300	440	G.E. (hoist)	600
300	440	Whse.	3600
250	2200/440	G.E.	1200
250	440/220	Whse.	600
250	550/440	G.E.	1200
225	4000/2300	G.E. (hoist)	600
200	440/220	Whse.	514
200	2200/440	G.E.	600
150	440/220	Whse.	720
150	2200/440	G.E.	600
125	550/440	G.E.	1200
125	2200	G.E.	600

SYNCHRONOUS MOTORS 3-Ph 60 Cy.

H.P.	Volts	Make	Type	R.P.M.
400	2200/440	G.E.	ATI	720
375	2200	Whse.	G	900
350	440/220	El. Machy.	Syn.	1200
300	2300/400	G.E.	TS	720
300	2200/440	G.E.	TS	1200
250	440/220	G.E.	ATI	600
150	440/220	G.E.	TS	720
125	440/220	Whse.	HR	400

SQUIRREL CAGE MOTORS

H.P.	Volts	Make	Type	Speed
600	2200	G.E.	FT	3600
500	2200/4000	Elliot	SC	1800
400	2300/4000	G.E.	K	1800
350	440	G.E.	KT	1200
300	2300/4000	L. Allis	FS	1800
250	440/220	G.E.	KT	720
250	2300	Whse.	CS	600
250	2300	G.E.	K	900
225(2)	2200/440	G.E.	KT	1200
200	440/220	G.E.	KT	1800
200	2200/440	G.E.	JK	600
200	2200	G.E.	KT	1800
150	2200	Al. Chal.	AB	1800
150	220	Whse.	CS	1200
150	440/220	G.E.	KT	720
150	2200/440		KT	600

A. C. GENERATORS

1—320 kva, 660 rpm 2300/440/220 V., G.E.
1—300 kva, 900 rpm, 2200 V., Whse.
1—225 kva 60 rpm, 220/440 V., G.E.
1—200 kva, 720 rpm 2200/440 V., G.E. (Ball)
1—187 kva, 1200 rpm, 2200/440 V., Whse.

CIRCUIT BREAKERS

2—2000 amp. GG E., 3 pole, 600 V.
2—1600 amp. ITE, 3 pole, 600 V.
6—FKR-155-23, 600 amp., 15,000 V. G.E.
1—400 Amp., Condit, 3P, 25 KV outdoor
1—400 Amp., R. Smith, 3P, 7.5 KV outdoor

D. C. MOTORS

H.P.	Volts	Make	Type	Speed
225	230	Whse.	SK	1800
150	230	El. Dyn.	B/brg.	600
150	230	Whse.	SK	1750

MOTOR GENERATOR SETS

KW	Make	Input V., Motor AC	Output V., Type DC
250	Whse.	2300	Syn. 250
240	G.E.	4000/2300	Syn. 250
150	Whse.	440/220	Sq. Ca. 275
125	G.E.	4000/440	Syn. 125
125	G.E.	440/220	Syn. 250/125
100	Al. Ch.	220/440	Sq. Ca. 240/120
65	G.E.	2200/440	Sq. Ca. 250

TRANSFORMERS 60 Cy.

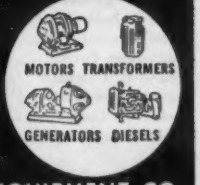
1—1000 kva, Whse., 13,800—2300 V., 3 ph., New
1—600 kva, Standard, 13,800—2300 V., 3 ph.
3—500 kva, G.E., 13,800—2300 V.
3—333 kva, G.E., 13,800—2300 V.
3—333 kva, G.E., 2400—480 V.
3—300 kva, G.E., 4150—240 V., 3 ph., Pyr.
3—200 kva, G.E., 2400—120/240 V.
3—200 kva, Mol., 13,800—2300 V.
3—150 kva, Al. Ch., 2400—220 V.
3—150 kva, Al. Ch., 440-220 V., dry, New

only partial listing

STEPHEN HALL & CO.
HARRY J. RICE, Pres.
625 ADAMS ST., HOBOKEN 2, N. J.

WORLD'S LARGEST INVENTORY

NEW AND GUARANTEED REBUILT EQUIPMENT



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ELECTRIC EQUIPMENT CO.
L. D. (Long Distance) 65
ROCHESTER 1, NEW YORK

Explosion Proof Motor Headquarters

DIESEL ENGINES — POWER MACHINERY

100 KW to 1500 KW

Diesel Generator Sets • Stationary • Portable • Mobile Motors and Generators

A. G. SCHOONMAKER COMPANY, INC.

MAIN OFFICE: Box 516, Sausalito, Calif. Sausalito 1600
BRANCH: 50 Church St., N. Y. 7, N. Y. Digby 9-4350

FOR SALE

AIR COMPPRESSOR: 2000-CFM, 2-Stage, 100# psig., 400-HP., 200 RPM. Motor. Complete with Starter, Exciter, Inner and After Cooler and Air Tank.

CHARLES WEAVER
19701 James Couzens Highway, Detroit 35, Michigan

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B.F.Goodrich

Belt shovels 1100 tons of coal an hour

It takes hundreds of tons of coal an hour to feed the boilers in this Ohio Valley power plant. But it's a long, steep climb from the storage pile up to the bunkers, so an unusually strong conveyor belt was needed.

B. F. Goodrich engineers recommended a belt made with B. F. Goodrich Nyfil fabrics. In this belt, nylon is used as cross threads in the fabric to give extra strength without adding weight. Use of nylon increases flexibility, so belt troughs perfectly whether empty, lightly or fully loaded. Belts made with Nyfil fabrics hold fasteners better, have greater impact resistance, can carry heavier loads farther, higher, than belts made with all-cotton fabrics, yet these longer-lasting belts cost no more.

As a safety measure, B. F. Goodrich built this belt with a new fire-resisting rubber which will not support combustion or spread fire. B. F. Goodrich belts, made with this rubber, have been accepted for listing as fire resistant by the Bureau of Mines. This special rubber also has high resistance to impact, abrasion, oil, grease, tearing, gouging and even mildew attack. So belts made with it can be expected to equal or surpass the long service records made by other B. F. Goodrich coal-handling belts.

Before you buy another conveyor belt, look into the cost-saving advantages you get with a belt made with Nyfil fabrics, and the safety you can get with B. F. Goodrich fire-resisting rubber. Your B. F. Goodrich distributor can give you full details, or write *B. F. Goodrich Industrial Products Co., Dept. M-689, Akron 18, Ohio.*

B.F.Goodrich

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5 Industries... Well-Known Companies

... typical of more than 100 companies for whom Grinnell is currently fabricating

POWER AND PROCESS PIPING

CHEMICALS
NATIONAL ANILINE DIVISION OF ALLIED CHEMICAL & DYE CORP., Hopewell, Va.

PULP & PAPER
UNION BAG & PAPER CORP., Savannah, Ga.

POWER
PENNSYLVANIA POWER & LIGHT COMPANY, Allentown, Pa.

BEVERAGE
CARLING BREWING COMPANY, Natick, Mass.

OIL REFINING
TIDEWATER OIL COMPANY, Delaware City, Del.

These successful companies, leaders in their respective fields, are building new facilities right now. The power and process piping needed in this construction is being fabricated in Grinnell shops.

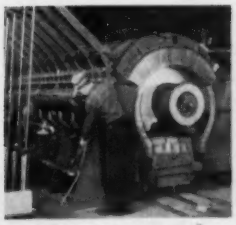
In fact, at this time — or at any given time, more than one hundred similar-type orders for prefabricated piping are being worked on by Grinnell. Why this marked preference by so many companies for Grinnell?

Because piping fabricated in Grinnell shops is done under ideal conditions, with modern equipment, by personnel qualified for each class of work. Included in the price (which is determined in advance) are such items of expense as: interpretive engineering, shop sketches and planning, procurement of materials, power services, expendable tools and supplies. All piping is rigidly inspected and tested to comply exactly with customer specifications and applicable codes. Consult Grinnell on your next piping job.

ATTENTION: *A 30-minute color sound film showing the quality and economy of Grinnell Shop Fabrication of all classes of piping is available for group showings.*

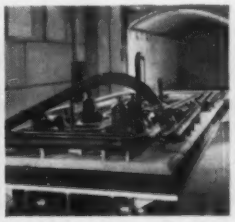
GRINNELL

WHENEVER PIPING IS INVOLVED

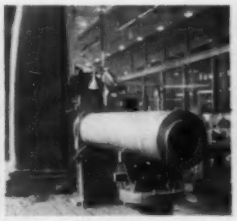


Pipe being heated to exact temperature required for proper bending

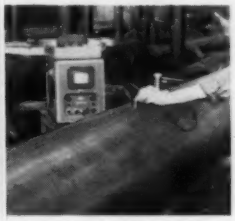
Skilled team completes bend in six minutes with pipe close to 2000°F



Fabricated piping, bending operation completed, enters stress-relieving furnace



Heavy wall pipe being machined to the proper welding bevel on a post mill

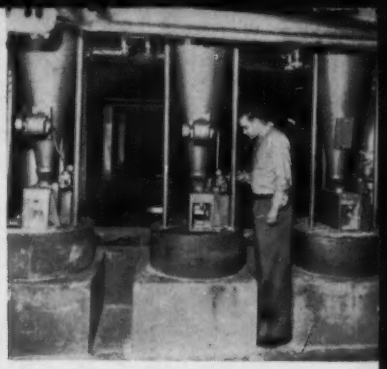


Ultrasonic testing of a weld on heavy wall pipe

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems

NEW VERMILION STATION
near Danville, Illinois, was designed by Sargent & Lundy. 75,000-kw Unit 1 went on the line in May 1955. 100,000-kw Unit 2 goes in service October 1956.



Chemical Feeders: 1st step in treati
all water for plant use is accurate d
ages of lime and alum for treatment
Precipitator.

1800 gpm Precipitator clarifies and s
tens cold river water. Dealkalizes, to
eliminating need for degasifier in
mineralization.

ILLINOIS POWER EXPANDS AGAIN!

Latest 175,000-kw station is protected by Permutit-conditioned water

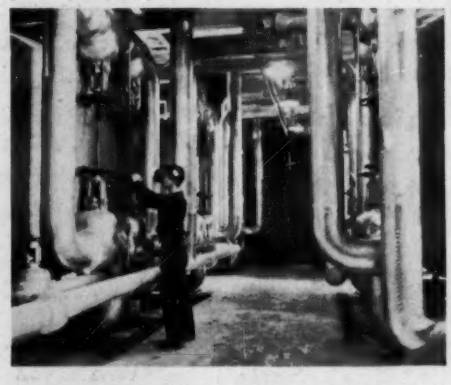
To meet rapidly growing needs, progressive Illinois Power Company has built two high-pressure stations within two years.

75,000-kw Hennepin Station went on the line in 1954. Its 1450 psig boiler requires *feedwater of the highest quality*. To produce this makeup, Permutit Demineralizers were installed.

When Illinois Power built the new Vermilion Station, Permutit water conditioning was installed again. To protect its turbine and boiler, all makeup is demineralized by the Permutit ion exchangers shown.

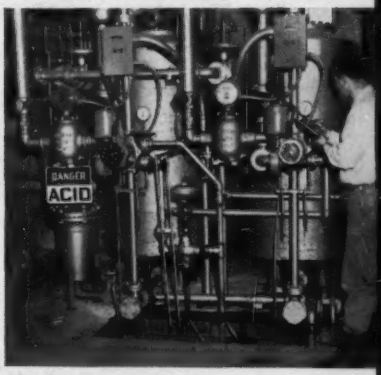
For Vermilion's big cooling-tower system, a different grade of water is most economical. The Permutit Precipitator and Filters shown produce it.

You can get this complete protection for your plant. We'll gladly help. Write outlining your problem. The Permutit Company, Dept. P-10, 330 West 42nd Street, New York 36, N. Y. Permutit Co. of Canada, Ltd., 207 Queen's Quay, Toronto 1, Ont.



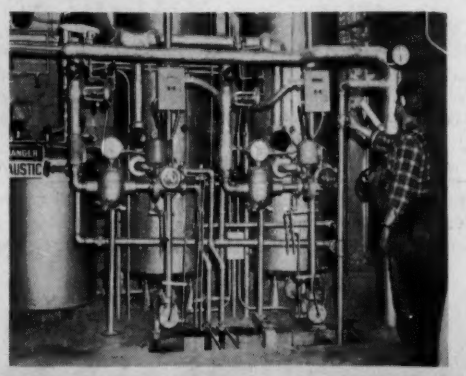
Pressure Filters further clarify Precipitator effluent . . . deliver finished water to protect Vermilion Station's 53,000 gpm cooling-tower system.

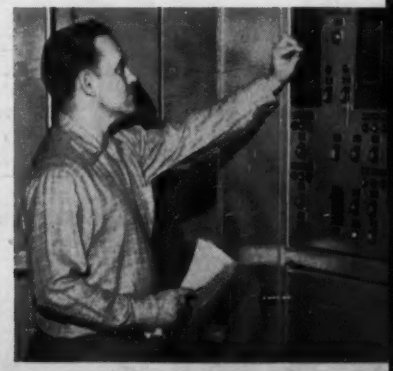
Anion Exchangers: Permutit S resin removes the few remaining minerals . . . protects Vermilion Station's turbine from troublesome silica deposits.



Cation Exchangers: Permutit Q resin
moves metallic cations from Precipitat
effluent to prevent boiler scale . . . all
high heat-transfer rates.

Control Cubicle operates demineralize
Determines end-point, then sequenc
backwashing, regeneration, rinsing,
turn to service. Even prepares regenera
charges.





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WATER CONDITIONING
Equipment • Resins • Experience